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[OFFICIAL NOTICE.]

American Gas Institute.—Bureau of Information.

AMERICAN GAS INSTITUTE,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., April 24, 1907.

To the Members of the Institute: The management of the Institute take great pleasure in announcing the formation of a Bureau of Information, composed of the following persons:

Name.	Subject.
W. H. Gartley, Chairman, U. G. I. Co., 22d and Filbert streets, Philadelphia.	Manufacture—Operation.
R. B. Brown, P. O. Box 824, Milwaukee, Wis.	Construction.
J. D. von Maur, care Laclede Gas Co., St. Louis	Distribution—Ordinary.
H. L. Rice, Western United Gas and Electric Co., Aurora, Ills.	Distribution—High Pressure.
F. W. Frueauff, 405 17th street, Denver.	Commercial.
E. H. Earnshaw, Fourth and Plum streets, Cincinnati	Residuals and Chemistry.

The members are invited to send *to the Secretary* all questions to which answers by the Bureau are desired. The Bureau will not attempt to do the work of a consulting gas engineer. It will in many cases rather attempt to indicate methods of solution, than actually solve the problem given. Where satisfactory answers already exist to questions asked, the questioner will be directed to these answers. Where the questions are incapable of a positive answer, the questioner will be so told. Where the matter is plainly one for a consulting gas engineer, the questioner will be advised to employ one.

All questions and answers that may be deemed of value to the membership in general, will be recommended by the Bureau to the Directors of the Institute for publication in the "Proceedings."

WALTON CLARK, President. JAMES W. DUNBAR, Secretary.

Rules to be Observed in Sending Questions to the Secretary for Answer by the Bureau of Information.—Wherever possible, all questions should be typewritten. Each question should be on a separate sheet of paper, size approximately 8½ inches by 11 inches. Each sheet should contain the name and address of the member asking the question.

[OFFICIAL NOTICE.]

Annual Meeting, Wisconsin Gas Association.

WISCONSIN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
RACINE, WIS., April 25, 1907.

To the Members of the Wisconsin Gas Association: The next annual convention of this Association will be held in Milwaukee, Wis., with headquarters at the Hotel Pfister, Wednesday, the 15th, and Thursday, the 16th, days of May next. Respectfully yours,

HENRY H. HYDE, Secretary.

BRIEFLY TOLD.

THE CHIEF'S DAY.—Last Thursday will be long remembered by Mr. W. H. Bradley, the respected and wholly beloved Chief Engineer of the Consolidated Gas Company, of this city, and that memory will also be bright and well-treasured in the recollections of the members of the Society of Gas Lighting and their guests, for it will hold on its pages the records of many things well done. The afternoon marked the actual sharing of the invitation extended by the Chief to the Society of Gas Lighting to inspect the magnificent works, now well along towards completion, of the Company at Astoria, and the evening was marked by a display on the part of his fellows of their recognition of the master-mind of the man that planned the pile, which in short time will stand as the foremost single gas works in the world, that seldom falls to any man. Not alone was the whole affair a tribute to his merit as an engineer, for it was equally telling in respect of his fellows' personal regard for him as an associate and as a friend. The day itself was not an inspiring one, for the misty drizzle of a raw May day was the atmosphere through which the "Moran" tugged the party from New York to Astoria. However, neither the dullness of the day nor the trend of the wind could quell the ardor of the voyagers, whose inspection of the magnificent plant was thorough. It would be useless to here attempt to even note the works and its surroundings; let it suffice to say that the words vast and complete will be fitting ones when the builders' tasks are at an end. That the inspection was not a matter of form can be understood in the rough, when it is said that quite 4½ hours were put in over it; that it was not perfunctory may also be surmised through the noting that some of the veterans did more climbing and tramping in the time marked than had been done by them—well, for quite a

LIBRARY OF CONGRESS, 1907, SMITHSONIAN DEPOSIT.

while. The larger parts of the two retort houses—respectively fitted with horizontals and inclines—were under fire, and the routine work was being carried on in them with precision and regularity. As it is not our purpose, though, to deal at all with the technical side of the matter, we leave that subject by repeating the remark that the plant is magnificent and vast. The return to New York proper was accomplished by 6 P.M., and in the College Room of the New Astor Hotel was later on brought to a happy termination the proceedings which were so fraught with interest at every stage.

On arriving at the Astor the regular business meeting of the Society was transacted, and then came the informal dinner. The real feature of the proceedings was the presentation to the Chief of a beautiful and harmonious set of engraved resolutions. The text was as the decorations were on the sheet, indicative and appreciative of the man (and he is every inch a man) whom the Society wished to honor. The speeches were from the heart, and it possibly is as well to say no more about them here than to declare that no lack of personal feeling was in their wording. In fact, few men live to hear such moving expressions of congratulation, of recognition, esteem, regard and affection as those that tingled through the ears of the veteran Chief in the Astor Thursday evening last, as he sat surrounded by his own engineering staff, the guests of the Society and his life long friends. It constituted a token well tendered. Prominent in the guest ranks were Dr. Bennett, Mr. R. A. Carter, Mr. C. G. Francklyn, Mr. H. W. Fuller and Mr. W. G. Hoyt. The burden of the arranging likely fell to the lot of Mr. W. R. Addicks, Mr. Geo. G. Ramsdell and Mr. Howard Bruce.

THE STATE COMMISSION'S STANDARD FOR GAS MAKERS TO FOLLOW.—The New York State Board of Gas and Electricity last week issued an order (the result of some weeks of study, investigation and resignation) to govern the gas companies in the State as to the candle power, etc., of gas that they must supply to their customers. We have not received a copy of the order, but the following may be taken as a fair reproduction of the main tenets of the measure. The standard is fixed in the order at 16 candles for coal gas, 18 candles for mixed coal and water gas, and 20 candles for straight carburetted water gas. The order further promulgates a standard of purity for illuminating gas. The presence of hydrogen sulphide is forbidden. The Commission announces that the results of tests made by its department recently established for the regular inspection of gas throughout the State demonstrated a need for raising the standard for the gas supplied. Continuous inspections of gas will be carried on in order that the Commission may see that the companies are complying with the standards adopted. The Commission gave a hearing to the companies of the State supplying coal, water and mixed gas some time ago and at that time the companies appointed a committee of 3 gas experts to report to the Commission their determination as to the proper standards to be established. That report was recently received by the Commission and recommended a standard 1-candle power lower than that established by the Commission's order, the recommendation being that the illuminating power be fixed at not higher than 15 for coal gas, 17 for mixed and 19 for water gas. The order directs that the power tests must be made at least a mile from the distributing holder of the gas company in each community. The standards established follow those in the pending bill of the Assembly Committee on Gas, Electricity and Water Supply, affecting cities of the second class. The Commission's order takes effect June 15. The passage of the Assembly bill will reduce the power standard of the gas in this city which was fixed in the dollar gas bill at 22-candle power, and will make the standard here 20-candle power.

CURRENT COMMENT.—

THIS month Mr. Howard Bruce leaves the service of the Consolidated Gas Company, of New York, to assume the engineering direction of the firm of Bartlett, Hayward & Company. May good luck go with him.

HEREAFTER "The Natural Gas Journal" will be under the management and editorship of Mr. Lucius S. Bigelow, but its ownership will rest equally in its founder (Mr. J. A. Mayers) and Mr. Bigelow. Its headquarters will remain as before, in 56 Pine street.

SPECIAL word from Grand Forks, N. D., goes to show that the authorities have decided not to rebuild the municipal electric lighting plant.

THE schedule issued some days ago by the proprietors of the Consumers Gas Company, of Johnstown, N. Y., which goes into effect July 1st, provides that the selling rate for gas used on illuminating account will be $1 per 1,000 cubic feet, and 60 cents for gas used on fuel account.

The Recent Fire in Station "A" of the San Francisco Gas and Electric Company.[1]

At about 7 P.M, Tuesday, April 2d, an alarm of fire was hurriedly sent in from Station "A" of the San Francisco Gas and Electric Company. A blaze of a threatening character had been discovered on the roof of the south boiler room, and only the timely and effective action of the fire department prevented the loss of a plant valued at from 8 to 9 million dollars. As it was, the loss will probably not exceed $150,000, though it was feared at first that the damage to the building and machinery would amount to over 2 million dollars. This station is situated at 22d and Georgia streets, in the Potrero district, and is the most important of the local electric stations in the system supplying San Francisco with electric power.

The destruction of this plant would have seriously crippled the electric lighting and power service in San Francisco, as the load is divided between the steam driven plant and the hydraulic plants in Amador, Butte and Yuba counties. There are installed in this plant 10 direct-connected units supplying the various sub-stations for distribution about 250,000 kilowatts hours daily.

The building is about 140 feet wide and 433 feet long, and is divided into an engine room and basement running the full length of the building and 2 boiler rooms. The walls are of brick. The roof was partly of glass and partly of wood covered with slate. It was at first supposed that the wood had become gradually charged by the heat from the smokestack and that the existence of conditions favorable to spontaneous combustion had caused it to burst into flame. This theory is, however, not substantiated by those who were familiar with the condition of the roof before the fire and who examined the unburned portion afterward.

During December of last year, owing to the great demand for power from this station, the boilers were forced to their utmost capacity and the possibility of fire was then feared. The roof was carefully watched at the time and it was found that the woodwork had not been affected in any way. It is probable that the fire was started by sparks thrown out from one of the furnaces. The fire in the north boiler room on the succeeding day probably originated from smoldering wood which had been overlooked by the firemen.

With regard to the damage done the roof of the south or new boiler room, about 90 feet of the roof of the engine room was burned away, while other portions were so badly damaged that it will be necessary to replace them. In the fire room the intense heat and the falling timbers destroyed the pipe covering, cracked valve casings, pulled pipes off their flanges and otherwise damaged the equipment. In the engine room the units designated by the numbers from 6 to 10, which are under the burned portion of the roof, were temporarily put out of service. On most of these the piping and tubes were broken or bent, the gratings and railings were torn away, and various parts were so broken or strained that it has been necessary to dismantle the units to a greater or less degree.

The switchboards, switch room and feeder cables were not injured. The units numbered from 1 to 5 and the steam generating equipment in the north boiler room, which form the greater part of the original equipment of the plant, were not damaged, so that at midnight, about 5 hours after the fire had been discovered and before the firemen had left the building, it was possible to start up 2 of the units and throw on the usual load, which they could easily handle during the succeeding period of light demand.

As soon as the firemen arrived, it was, of course, necessary to shut down the plant, but before doing this the greater part of the load was transferred to the transmission lines from the hydraulic plants and to the reserve gas-driven units in the Martin power plant.

At about 11:39 P.M., at which time the fire was nearly out, the exciter set in the north end of the building was started and a little later one of the engines was started up with atmospheric exhaust. Several of the lighting circuits in the building were connected in as it was deemed advisable to test out for short circuits while the firemen were still in the vicinity. As soon as electric power was available for operating the motor driven circulating pumps for the condensers, an additional unit was started up and both engines were run condensing. The load was then gradually thrown on.

While the firemen were carrying on their battle with the flames, messages were hurriedly sent to the operating engineers from other stations of the Company, and employees were sent out to gather up a large force of men. As soon as practicable the men were divided into gangs and began the work of clearing away the debris. In a remark-

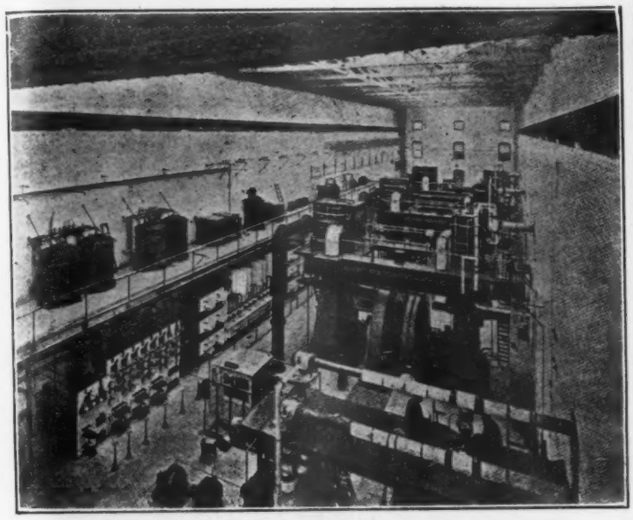
1. "Electricity, Power and Gas."

ably short space of time the fallen timbers and other wreckage were carried out. Under the direction of the engineers the work of examining and repairing the damaged equipment was undertaken as soon as conditions would permit.

All efforts were devoted to getting the plant ready for immediate operati n and much of the work done is, therefore, only of a temporary character. The greater part of the required materials was necessarily taken from the most available sources. Owing to the scarcity of copper gaskets rubber gaskets had to be used instead.

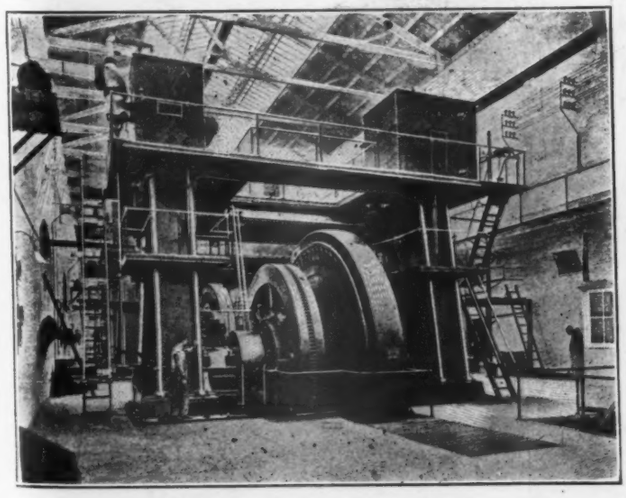
On the following day after the fire, all the districts in San Francisco were receiving their normal amount of power, and on Friday morning, 2 days later, all the units were in operation but one. The generators in the exposed part of the building are protected from falling mist by large canvas coverings.

The northern half of Station "A," and most of the equipment in-



General View Station "A" of the San Francisco Gas and Electric Company.

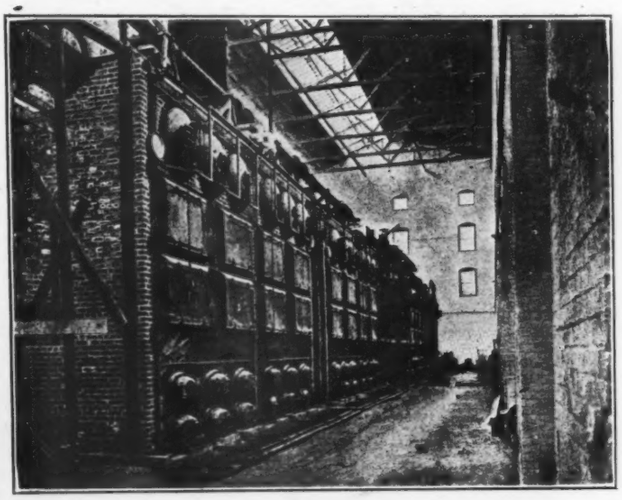
stalled therein, were built in 1901 for the Independent Electric Light and Power Company and was later purchased and its capacity more than doubled by the San Francisco Gas and Electric Company. The older units consist of 5 McIntosh and Seymour vertical, cross-com-



One of the 1,500-Kilowatt McIntosh and Seymour-Westinghouse Units.

pound engines direct-connected to Westinghouse alternators supplying current at 500 volts and having an aggregate capacity of about 7,500 kilowatts. At the time of its installation it was considered one of the most modern plants in America, and though practice and operating conditions have changed considerably since then, it compares very favorably in many respects with the installations of the present time.

The new equipment, however, conforms to the most modern practice

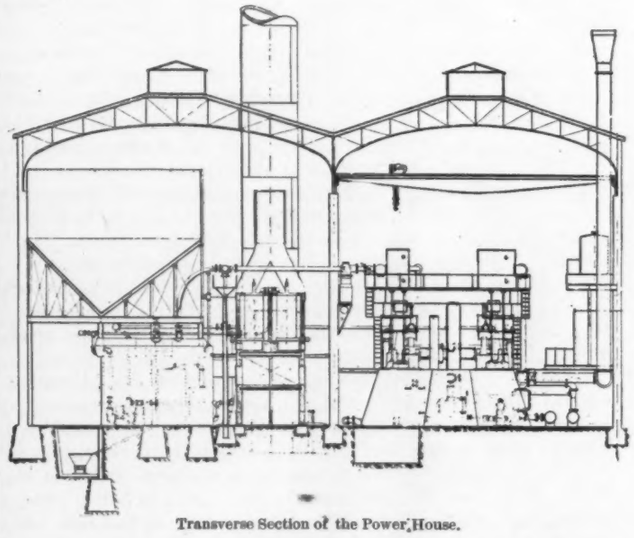


Transverse Section of the Plant.

in the selection of machinery for large power stations. The new generating units are 5 in number. The engines are all of the vertical type and are operated by steam at 185 pounds pressure, with a normal superheat of about 125° F. Direct connected to these are 3-phase, revolving field, 60-cycle alternators, which supply current at 11,000 volts to underground feeder cables running to the various distributing substations.

No. 6 unit consists of a McIntosh and Seymour cross-compound engine of dimensions 28 by 58 by 48 inches driving a 1,500 kw. Westinghouse alternator. The remaining 4 engines are of the triple expansion type and were built especially for this plant by the Union Iron Works. The engines for units Nos. 7 and 8 are of dimensions 24 by 36 by 54 by 36 inches. The alternators are also 1,500 kw. machines of the Westinghouse manufacture. Units Nos. 9 and 10 each have a capacity of 3,500 kw. The engines are of dimensions 36 by 66 by 90 by 48 inches. The alternators were built by the General Electric Company.

The Wheeler "Admiralty" surface condensers are used. These ordinarily give a vacuum of about 27 inches of mercury. In connection with the condenser for the McIntosh and Seymour engine an Edwards 3-throw air pump driven by a 50-horse power, 3-phase induction motor is used. The air pumps for the triple-expansion engines are built within the engine frame, the pistons being actuated by a link motion operated from the cross-heads of the high pressure cylinders.



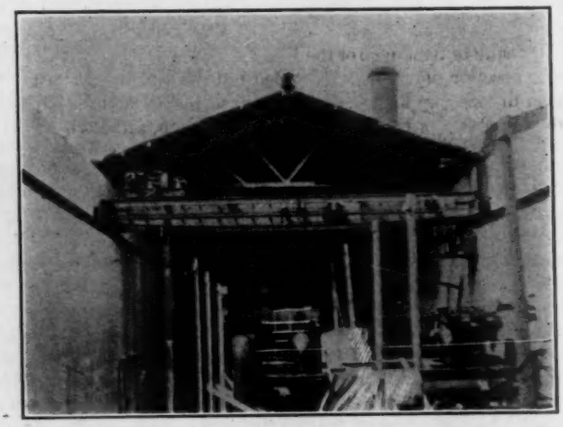
Transverse Section of the Power House.

The circulating water is supplied from the San Francisco Bay by 4 Byron Jackson, single-stage, centrifugal pumps located in a pump house situated about 1,500 feet from the plant. Three of these are direct connected to 100-horse power, 500-volt, 3-phase induction motors, and the fourth, which is much larger, is driven by a 350-horse power, 11-000-volt, 3-phase synchronous motor. The smaller pumps have 16

inch suction pipes and the larger pump a 30-inch suction pipe. The 4 pumps feed into a single 36-inch main. The discharge from the condensers runs back to the Bay by the force of gravity.

The new boiler equipment consists of 6 Heine and 9 Babcock and Wilcox water-tube boilers which generate steam at 185 pounds pressure

The New Boiler Room, Showing the Condition of the Pipe Covering after the Fire.



Five-Ton Electric Crane and View of Engine Room After the Fire.

with a superheat of about 125°. The Heine boilers, each of which is rated at 500-horse power, are set in one battery, the furnace gases passing into a single Heine, steel stack, 96 inches in diameter and 100 feet high. The Babcock and Wilcox boilers, which have a rated capacity of 780-horse power each, are set in 2 batteries of 6 and 3 boilers respectively. The furnaces are connected to three 72-inch Babcock and Wilcox, steel smokestacks also 100 feet high. The furnaces are oil burning, the Wilgus burner being used with the Heine boilers and the Hunt-Mirk burner with the Babcock and Wilcox boilers.

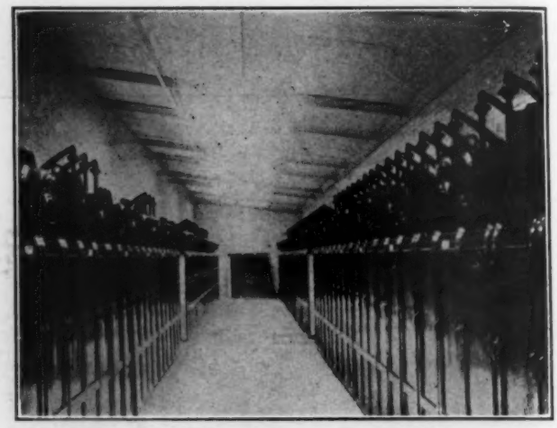
The feed water and oil pumps are located in the southwest corner of the new boiler room. There are 2 tandem, duplex, Snow feed-water pumps, 12 by 19 by 10 by 18 inches, and 2 Snow oil pumps, 8 by 5 by 10 inches. Goubert heaters and Green economizers are used.

For the storage of fuel oil there are 3 riveted steel tanks, 2 of which have a capacity of 25,000 barrels each and the third a capacity of 10,000 barrels. These tanks are located near the water's edge and are filled directly from oil barges.

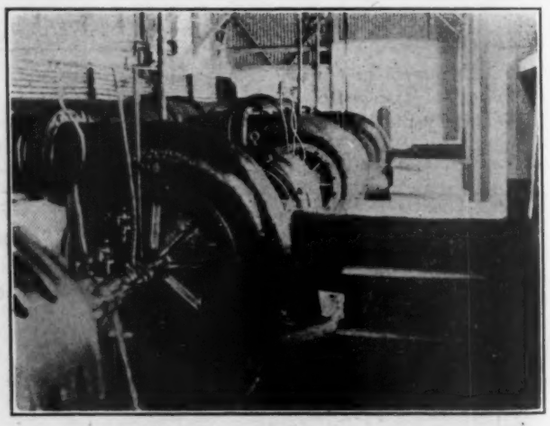
One of the interesting features of this plant is the lubricating oil system. The apparatus is kept in a special oil room, which occupies half a small corrugated iron house built apart from the main building. The oil after passing through the bearings of the engines flows by gravity into a receiver tank placed in the basement below the engine room. From there it is pumped by a Dow 3 by 2 by 3-inch pump to a settling tank, which is the middle one of 5 tanks set in a row. In this tank the oil and accumulated water and foreign matter are allowed to settle until they are well separated. The oil is then drawn off through a strainer into a receiving tank from which it is pumped by another Dow pump to either of the 2 kettles on the right and left of the settling tank. Live steam is circulated through the iron steam coil in the kettle until the separation is practically complete. The oil is allowed to cool and is then drawn off into 1 of 4 supply tanks placed on the floor or, if these are full, into the storage single main running to the engine room. Within the tanks a pressure of about 60 pounds is maintained by connection tanks on the right and left of the steam kettle. The supply tanks have a capacity of 145 gallons each and fed into a line with a steam driven air compressor, so that the oilers can get their oil from the distributing pipes by merely manipulating a valve or cock.

The Shaw electric, girder-crane shown in the photograph was in constant use during the repairs to the damaged engines. It has a capacity of 10,000 pounds.

This electric power station is operated entirely for the generation of power. The distribution at the required voltages is accomplished from sub-stations placed in various parts of the city. In the switch room shown in one of the photographs there are 38 General Electric, remote motor control, oil switches connected to the double sets of bus-bars, there being 2 switches for each of the 10 generating units and two for each of the 9 feeder cables.



The Switch Room, Showing the Remote Motor Controlled Oil Switches.



Centrifugal Pumps Driven by Induction Motors. These Supply Water to the Condensers.

It is intended to avoid the repetition of the recent fire from a similar cause by the construction of a fireproof steel and reinforced concrete roof.

[Prepared for the JOURNAL.]

Chats with a Meter Taker.

By "INSPECTOR."

Speaking with a gas man who spent a good part of his life taking the meters of and making repairs on the same in houses, public dwellings, office buildings, etc., he narrated some interesting events of happenings in connection therewith. One of his most exciting adventures occurred when a man, whom he thought was crazy, attacked him, supposing him to be a second story thief. The man proved to be a Frenchman, so explanations could not be quickly made; the one assuming the other was a crazy man, the former thinking he had encountered a burglar, an interesting and lively scene was enacted in the corridor. The men grappled and rolled about the floor; the Freachman was sure that the

kit of tools which the gas man carried was a burglar's kit. The two fought and bit for a few minutes until aid came and the gas man was recognized by some of the occupants of the house. Explanations followed, likewise a treat—the Frenchman paid the bill.

On another occasion the arrangement of the building was such that a ladder had to be climbed in order to reach an apartment in a building through which the gas mains passed, and it so happened that one of the workmen of the establishment slept in this room. While he was taking an afternoon nap on a holiday, the gas man mounted the ladder to go into the apartment. The sleeper awoke and, without further ado, reached out and pushed the ladder over from the wall. Fortunately the gas man, who was only a few rounds up, jumped to the ground without injury. The workman explained he dreamed of being robbed and awoke just in time to see the gas man coming up the ladder. The impulse of self-defense seizing him, mechanically he reached forth forth and pushed the ladder out and down.

Once, the rich landlord of a building in which my friend was taking meters claimed he was not getting a square deal. This rich, bloated individual "Waited for me with a club, said the gas man"; but I saw him first and went out through a back window, leaving the puffy individual standing there with his stick of wood. I afterwards learned that he used strong language when he found I had gone. I was always on the alert when I went to the houses of this man. Although I recorded faithfully, he was prone to accuse me of cheating him. I am so used to being thus accused that I pay little attention to it.

He waited for me with a club.

THE KEG STRUCK ME ON THE HEAD.

The animated meter.

Once a lady of the house bothered me so much about charging too much for gas that I thought to play her a trick. She threatened to put in a new meter which she claimed she could read, and inquired the price of the same. I furnished one for her, and turned it over to her to set up and connect. As expected, the next trip I made found the meter waiting for me to put in. I saw some rubber hose in the basement and connected it to the meter. When the lady came to the dark cellar, I turned the water on, full force. The result was the hose filled out and began to make the meter pound-and-jump, and the hose line twisted and squirmed under the pressure of the water. The lady afterwards told me that, in the dim shadows of the basement, the thing looked like the "Head of a reptile with its squirming tail." Nothing further was done about the meter.

Gas men have to get accustomed to all kinds of remarks and insinuations. Not only does the lady of the house call you down, but the kitchen girl gets in her work once in a while. This adroit young person often burns the gas until midnight, entertaining her young man in the kitchen. Frequently the "boss of the house" is soundly sleeping all this time, and is not aware of the fact that the gas meter is steadily climbing up. But when the end of the month comes he wonders how it is that the bill is so high when he went to bed so faithfully at 10 o'clock each night. Then there are careless house help, who leave the lights in the basement going all night, to be discovered when they go down early in the morning after fuel to start the fire for breakfast. The light is turned out then, but you are not told anything about it, and at the end of the month you blame the gas man or the company for high bills.

Some very effective scolds the gas man must make contact with on his rounds. I recollect one woman who used to scold me every time I took the meter, and who oftentimes impressed me deeply with her words by accompanying her remarks with a poker which she swayed with grace. And while she has not yet permitted it to come into contact with me direct, several times it has almost touched me in making the circles which accompanied her words. She always took a firm stand just outside the door and gave utterance to various thoughts.

Again, there are people who really abuse us. I remember passing through the Italian quarter of a certain city to "get the meters" and effect some repairs. As I passed along a wall to examine a meter a keg struck me on the head. It came from an open window above. I went after a policeman, whose effort to locate the culprit was unsuccessful. Fortunately for my head, the keg was neither large nor heavy. The people of the vicinity told me later who the man was. When I asked why they told me they said that they feared I would take it out of them by charging up an excess of gas on their bills. Evidently they do not have a very large respect for the business honor of the gas man who takes meters in the Italian section.

Then there are people who try the bribe act—not always in cash, but in presents. I can always tell whether the present is meant by the giver to be a bribe, for the purpose of softening the heart of the hard-hearted gas man, or simply a friendly gift. Now, a social gift of a cigar, a drink of lemonade or the like, is not amiss; nor is it a bad thing to have a section of nice pie "handed out" to you by the pastry cook. It never did me any harm, nor did it cause me to favor the donor. I try to be square for both sides and think I am, although errors will happen occasionally. You cannot expect a meter to register just right year after year. The mechanical part may get wrong, for such things have happened. You get your figures wrong as a result, and if you are not careful you will gain a foe if the mistake is made in favor of the company. If in favor of the consumer, it will be all right and you will be called a good fellow.

Accountancy In the Gas Business.

By H. L. MILLSPAUGH.

System for Handling the Accounts of Consumers, in which the General Methods are Ably Discussed and Illustrated. Ledger, Reading and Other Forms are Reproduced.

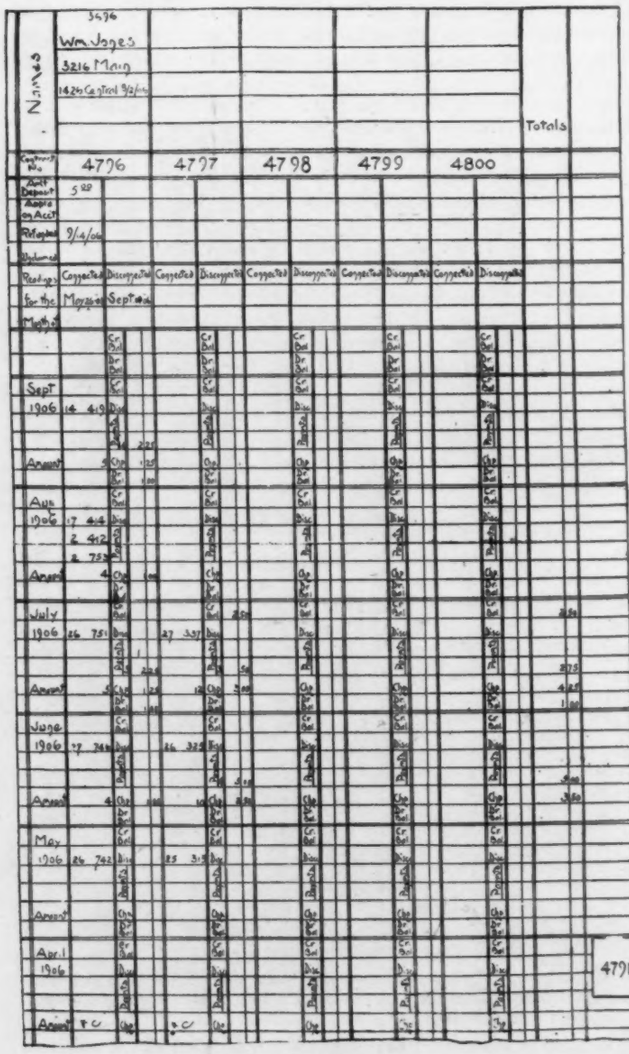
In treating this subject, I shall confine my remarks to the handling of consumers' accounts only, as the voucher system, which is used in our general bookkeeping, need not here be commented upon. The records used are the consumers' ledger, daily cash book, reading card and street card.

Ledger.—The ledger is 16 by 22 inches, closed, with a very cleverly arranged numerical index at the margin, which permits of the book being opened at the account desired with accuracy and dispatch. It is ruled for 10 accounts to the double page and each account is divided into 12 months. Ample space is provided for the meter readings, amount consumed, Dr. balance, charge, payments, discount and Cr. balance. The accounts are opened at the bottom of the page and closed at the top, the balances, if any, being extended into the column provided for this purpose. This arrangement permits of the readings being entered one above the other, thus avoiding mistakes in making deductions. All the totals, except the amount consumed, are carried at the margin of the right hand page, the amount consumed being carried on the left hand page, and, as there are only 10 accounts to the double page, the cross-adding is a comparatively easy task, and no trouble at all where a machine is used.

By referring to the columns marked *A* and *B*, it will be observed that a complete balance is obtained each month. By the use of a machine, the totals of the several pages are carried to a sheet, under the headings indicated in the ledger, this sheet constituting the trial balance.

Cash Book.—The cash received each day from the collections, as shown by the receipt stubs, is listed, by account number and added, by the use of a machine, upon a loose leaf and the total carried to the general cash book.

Sub-totals are thrown in at convenient points, and at the same points in the trial balance sheet, and, should the total of the payments in the ledger at the end of the month fail to agree with the cash book, the discrepancy can very readily be located by comparing the sums of each



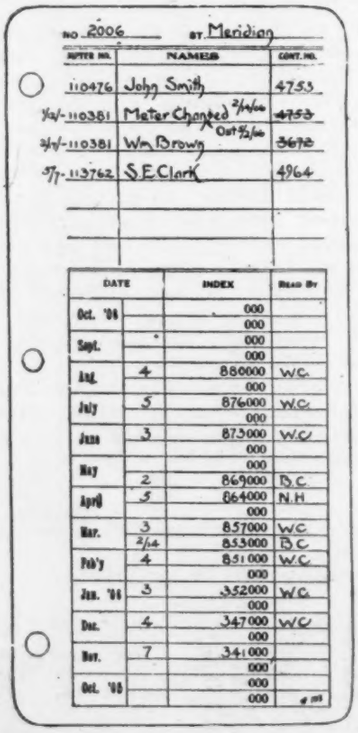
The Ledger.

day's collections at any given point with the sum in the trial balance sheet at the same point.

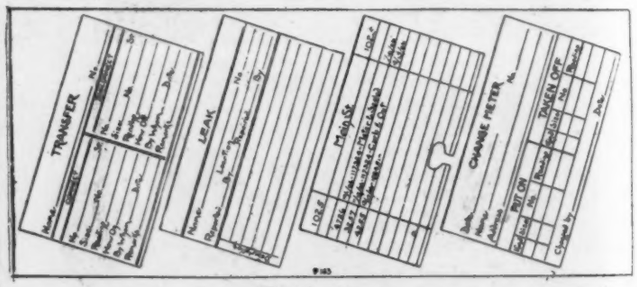
Reading Card.—The reading cards are loose leaf 4½ by 9 inches, and can be conveniently carried in the coat pocket. Space is provided for all the necessary information, such as: Name, location, account number, meter number and readings. By using only one card for each location, and entering each new consumer's name and contract or account number thereon, the reading, as shown by the "turn-on slip" of each new customer, must correspond with the reading recorded on the card when the gas was turned off, should the meter have been continuously sealed during the interval.

Street Card.—By the use of the street card we keep a complete record of all connections and disconnections. These cards are the regular 3 by 5—38-index cards, ruled as illustrated. The first space is used for the street and number, by which the cards are filed. The second space, for designating the particular part of the building, where there is more than one connection to the street number; also, for recording the irregularities, if any, in the manner of making the connection. If this space is blank it is understood that there is but one connection made in the regular manner. The remaining spaces are used for data; the left half showing when turned on, the right half showing when and how turned off. The disconnections, or "offs," are kept in a separate file, which makes it an easy matter to obtain, at any time, a list of same for the inspector whose "O. K." is recorded on the back of the card. As the cards are filled they are taken out and filed away and replaced by new ones.

In opening a set of books the reading cards are made up, routed and divided into sections, keeping the streets intact as near as possible. They are then numbered with a numbering machine and as many blank numbers left between the different sections as deemed necessary for new contracts. The accounts are then opened in the ledger from these



cards, thus causing the ledger to be routed and the accounts numbered exactly in the same order as the reading cards, which enables the posting of the monthly readings to be done in the shortest time possible.



The Other Forms.

Blank contracts or deposit receipts for new contracts are then numbered up for each section, beginning with the next number to the last reading card in each section, and the contracts or receipts for each section lettered, so there can be no confusion. These blank forms are filed in some convenient place on the counter near the contract window. A list of the streets composing the different sections is made up and placed on the counter for reference in making new contracts. On all new contracts, the reading card, street card and ledger accounts are made up from the connection slip.

As the reading card is put in place, the stamped number which it follows (called the delivery number of the new card) is entered on the connection slip, and this number placed at the top of the ledger account when opened. As the bills for the following month are numbered and addressed, this delivery number is placed on the bill and the bill, after being made up, is placed for delivery according to the delivery number instead of the contract number. All the transfers are handled in the same manner. Where the bills are not delivered this delivery number can be dispensed with.

We find that by dividing the city into sections and causing the bills to become due one day after the meter is read and payable within 5 days thereafter, the readings can be obtained, delinquent notices delivered and inspections made with a much smaller force than is necessary under any other system yet tried, and as the sections become due one after the other the delinquents can be watched much closer with less work.

The meter is read and the bill delivered on the following day, at which time all the "pick-ups" are obtained. In order to avoid any extra trips on these "pick-ups," the bill, with the previous reading, is attached to the "pick-ups" and the reader makes the extension, deliv-

ers the bill and returns the "pick-up" card with the reading to the office. The "pick-up notice" is a great help, as the readings are practically all obtained after the second trip. This system is suitable for a large or a small business, and either the loose leaf or the bound ledger may be used.

House Piping and the Like.

In the course of his paper on "House Piping," read by Mr. Edward D'Aprix at the April meeting of the "Quiz Club," the author said:

There are many reasons why this subject is an important one, particularly at this time, when we are experiencing some difficulty here (Rome, N. Y.) on account of old and inefficient house piping systems. We have had several complaints from consumers not being able to get enough gas to fill the mantles, and have proven in each instance that the trouble was not in the gas, but in the pipes being too small and filled with rust and scale. We have had systems which we cleaned and found to contain from a handful to a quart of this substance, which in some instances has been accumulating the last 50 years. We had a consumer who could not be convinced that the trouble was not in the gas until we took down his piping, cleaned it, and, by the satisfactory result attained, proved to him that the trouble lay not in his gas, but in his lack of facility for taking it from his meter. He could then see that while he was getting his supply of gas from the same main as his next door neighbor, who has good light, that the trouble was in his own piping.

This trouble will always arise when too small pipes are used. In years gone by, people thought as long as the pipes were large enough to supply gas that was all that was required, never taking into consideration the fact that they might add more openings for light or fuel, or that the pipes would gradually accumulate scale and rust which would decrease the flow of gas.

You would never think of laying a floor in your house just strong enough to support your own weight, or lay a sewer just large enough to carry off the water from one faucet, yet the same thing applies in piping your house for gas. When the New York Central and Hudson River Railroad Company build a bridge, after finding the strength necessary to carry the load determined, they build the bridge six times as strong for any overload which might pass over it, and to take care of the inevitable deterioration due to the action of the elements in the passage of time. The first cost of installing a system of ample capacity is small compared with the cost of enlarging it later, which means taking up carpets, floors and doing the work all over, besides the inconvenience of not being able to get enough gas.

For the protection of the consumer in some cities the gas companies have adopted rules which require a certain standard size piping and must be free from taps. After application for gas is made an inspector is sent to look over the piping, and if found of ample capacity, he is served with gas, which protects the company against complaints caused by small and defective piping. The same thing might apply with your own coal dealer. If your furnace was too small to heat your house properly, the trouble would not be in the quality of the fuel. If a gas company attempted to increase pressure on its mains so as to supply sufficient gas to the people who have stopped up piping systems, it would mean that the majority of the people whose piping is of sufficient capacity would have to readjust their burners continually and this pressure would also result in a largely increased breakage of mantles.

We have had cases recently of blowing out systems which have been in use a long period of time, the pipes being nearly filled with rust and scale, that by blowing them with air pressure have plugged the pipes entirely at some sharp bend or trap. It is always understood when we are asked to blow systems, generally the last resort, that the consumer takes the chance whether he gets gas or not. If you will take into consideration the cost of piping, as compared with the cost of other improvements of the same nature, you will find it does not pay to use too small pipe and fittings. When we furnish gas to the consumer under good pressure as far as the meter, our responsibility ceases; any fault in the system beyond the meter is up to the consumer. It is pretty good common sense to abide by the plans of the railroad company. Build your bridge strong enough and you will save endless trouble.

It is remarkable to pass houses uptown where there are up-to-date gas appliances and see the parlor lighted with big, red-flame oil lamps, which is a self-confessed evidence that economy has never been thought of. When you use that kind of light and think you are burning oil, when you are burning a gas produced from the oil, which is the most expensive kind of oil, as it is produced in a small, inefficient gas plant of your own. If people want that flat-red flame and want to use that pretty parlor lamp, connect it up with gas lamp attachments and stop that filling-the-lamp habit. But why even stop here, when you can take the same lamp, put an up-to-date burner with mantle on it, and cut the cost of gas in two and get more than 6 times the light. Had you ever thought of it?

The time has come when people are finding out how much cheaper they can use gas than any other light. It is just as reasonable to try and make your own gas from oil as cheap as you can buy it, as it would be to make your own lead pencils cheaper than you could buy them in the store.

In the good old days when our ancestors had to use tallow candles, because they had nothing any better to light with, they thought that was pretty good light, and it was at that time; but compare the two lights as to cost and efficiency. When you consider the old as compared with the new method of lighting, it is obvious that the present conditions are more favorable than ever before, which proves that gas can be used with greater efficiency at a lower price than any other light or fuel known.

Gas Versus Steam.[1]

By Mr. Louis Illmer, Jr.

During its long years of application the steam engine has undergone many radical improvements. Of these, by far the greatest number have tended toward increased economy of operation. Now that the limit of thermal efficiency of the steam engine has nearly been reached, later improvements have had a constantly decreasing effect upon the attainment of a better fuel economy. Only after the fundamental steam engine principles have been entirely abandoned can marked improvement in this direction be secured.

The necessity of this step was realized by early inventors who, after much effort, finally evolved the internal combustion engine. The limit of thermal efficiency of this engine is several times that of the steam engine. In fact, it was this high inherent economy of the gas engine that from the very beginning insured the splendid success which this later form of prime mover has now achieved.

Efficiency of transformation in the heat engine depends in a large degree upon the effective range of temperature through which the engine works. Both the steam engine and the steam turbine are inherently restricted to a comparatively small temperature range. In the steam system the furnace heat must be transmitted through the metallic boiler plates, and these naturally cannot be subjected to such extremely high temperatures as are necessary for highest economy.

In the gas engine, on the other hand, the combustion takes place directly in the power cylinder. This process readily overcomes the disadvantages of a low inherent temperature range, with the result that its limit of thermal efficiency is the highest attainable in any form of prime mover. Although this high efficiency is reduced somewhat by the water jacket, still the net brake efficiency of the large gas engine is more than twice as great as that of a first-class steam engine.

In the early stages of the development of high powered gas engines, serious difficulties were encountered in applying the high pressures and temperatures such as are required for marked increase of economy. However, with the vast amount of practical experience which has been gained in recent years, the progressive gas engine builder is now enabled wholly to fulfil the most exacting of modern engine requirements. As a result, there are at present almost a million horse power of high powered gas engines in successful operation, and many times that amount in smaller units.

In consequence of the highly satisfactory results obtained, almost all of the prominent steam engine builders now concede the advantages of the internal combustion engine, in that they are either negotiating for or have already taken up the building of large gas engines.

The gas engine industry was given a decided impetus when it was found that this engine could be so successfully adapted to the use of waste gases—blast furnace and coke oven gases in particular. A brief review of the sources of these gases will assist in showing the vast possibilities of gas engine application.

In pig iron making, large volumes of compressed air are forced into the molten mass of iron ore and coke. The resulting imperfectly burned products of combustion are known as blast furnace gas. Approximately 1 ton of coke is required to reduce 1 ton of iron ore, and almost three-fourths of the heating value of the coke passes off in the blast furnace gas. Of this gas about one-third is used to preheat the

1. The *Gas Engine*.

incoming air blast. In the older steam driven plants, almost all of the remaining two-thirds of the available gas is used under boilers to generate power for the blowing engines, which produce the air blast required for the blast furnace. Large as is this amount of gas, it sometimes proves insufficient for the needs of the older steam-driven steel plants, and for additional power recourse must be had to coal fired boilers.

In the gas engine plant the gas is much more economically utilized. Inasmuch as the blast furnace itself serves as a gas producer, it entirely eliminates the first cost of the gas generating plant. The waste gases coming from the top of the blast furnace simply pass through a dust separator and a series of scrubbers to the gas engines. The net or brake efficiency of such a plant is very high; in actual practice it will easily reach 23 per cent., as compared with less than 10 per cent. for a high class steam engine plant. In other words, from the limited amount of gas available for power purposes, the gas engine will deliver considerably more than twice as much work as will the steam engine. This means that after preheating and supplying power for the air blast, the gas engine plant, when in continuous operation, will produce a surplus of power over the steam engine plant of about 400-horse power for every ton of pig iron produced per hour.

Production of pig iron in the United States now amounts to more than 24,000,000 tons per year and represents more than one-third of the production of the entire world. When the gas engine has displaced the steam engine in steel works power plants, as it inevitably must, it will produce an average surplus of power over the steam engine plant of more than 1,100,000-horse power operating continuously throughout the year. This surplus power may be used to drive the central stations which furnish electric energy for the numerous auxiliaries and appurtenances of a modern steel plant as well as to supply electric current for lighting, railway and power purposes.

One of the first concerns in this country to realize the material advantages accruing from the blast furnace gas engine system was the Lackawanna Steel Company, who for some years have been operating the largest gas engine plant in the world, consisting of 40,000-horse power capacity in 2,000-horse power units.

Only an insignificant portion of the enormous power available from blast furnace gas has as yet been utilized. All our large steel companies, however, are giving this matter their earnest attention. As a consequence of the encouraging results obtained from a large number of plants for some years in operation, the leading steel companies are now in the act of replacing their steam equipments with gas engine plants. The United States Steel Corporation alone has recently placed orders for over 100,000-horse power of such engines.

Another by-product gas which is successfully employed for driving gas engines is the coke oven gas. The coke production in this country amounts to more than 35,000,000 tons per year. The rich by-product gas generated in the coking process contains about 20 per cent of the heating value of the coal. Since only a little over one-half of this gas is required to carry on the coking process, the remainder is available for power purposes, and if fully utilized would produce another 600,000-horse power, operating continuously throughout the year.

A third gas capable of being used in the gas engine is natural gas, new sources of which are being constantly discovered. Natural gas is now being distributed to many parts of the country by means of pumping stations, for which purpose high powered gas engines are almost exclusively used. The production of natural gas in the United States is increasing yearly, and from this source alone fuel for many millions of additional horse power could be supplied.

For localities not favored with this form of fuel, the gas producer can be profitably employed for gas engine use. The notable recent improvements in gas producer construction have made it possible to gasify even the cheapest grades of coal on a commercial basis.

High fuel coal, low cost of operation, freedom from danger of explosion and other noteworthy advantages, attest the superiority of the producer gas engine system over the boiler steam engine system. As a result of the high economy of the gas power plant, the bunker space required for coal storage is less than half of that necessary for the steam power plant. The low coal consumption of the gas power plant renders the station far more independent of labor troubles and coal strikes. The large and extensive chimneys of steam plants are replaced by stacks of less expensive construction. The absence of all soot and smoke is another advantage of the gas engine plant, easily satisfying the most stringent smoke nuisance ordinances.

While a new system of prime movers may be entirely satisfactory as to its underlying technical and mechanical principles, still its ultimate success or failure is measured by the saving in dollars and cents which it is possible for it to effect. For the best financial returns the fuel economy of the engine must be high, but the required thermal efficiency must not be bought at the price of either excessive first cost of machinery or operating expense.

To arrive at the total cost of power, it is necessary to consider first, cost, depreciation and interest, attendance, supplies and fuel cost. For the purpose of comparison, the writer has made complete tables of the cost of power for the three most economical types of prime movers of the present day:

The steam turbine, the Corliss steam engine and the producer gas engine. These tables have value as being based upon a large number of actual reports, and by the way of illustration, one series of tables has been abstracted and is presented herewith.

The so-called capital charges, given in Table I., represent a certain percentage of the first or complete cost of installation, this percentage being made up of the rate of depreciation, interest or investment, taxes and insurance. The cost of power in electrical units is usually deduced for a kilowatt, acting for 1 hour, or in some cases for 1 year, termed kilowatt-hour or the kilowatt year, as the case may be.

TABLE I.—*Capital Charges per Kilowatt of Station Capacity.*

Prime Mover.	Steam Turbine Plant.	Corliss Engine Plant.	Producer Gas Engine Plant.
Total cost of station per kw., including 33 per cent. reserve capacity	$114.00	$128.00	$135.00
Capital charges, including depreciation, interest, taxes and insurance, per kw. year.	14.40	14.80	17.00
Per kw. hour	0.334c	0.334c	0.394c

Table II. shows the so called fixed charges per kilowatt-hour of the power cost and includes all expense except fuel, being made up of capital charges, repairs and maintenance, the cost of supplies and attendance, all of which vary but little with changing load conditions for a given size of station.

TABLE II.

First Charges per Kilowatt-Hour—50 Per Cent. Load Factor.

	Steam Turbine Plant.	Corliss Engine Plant.	Producer G. Engine Plant.
Capital charges	0 334c	0.344c	0.394c
Repair and maintenance	0.047	0 038	0.050
Oil, water and supplies	0.063	0 063	0.052
Attendance	0.110	0.122	0.131
Fixed charges per kilowatt-hour	0 554	0.557	0.627
Fixed charges per kilowatt-year	$23.90	$24.10	$27.10

Table III. shows the net thermal efficiency of the station and the corresponding coal cost per kilowatt-hour for varying prices of coal. On account of the variable nature of the demand on all power stations, the mean or average load during a day or year is only a certain percentage of the rated capacity of the station, which percentage is designated as the load factor. The tables here given are all based on a 50 per cent. load factor, which accounts for the seemingly low thermal efficiency of the station. It will be seen that in a modern boiler steam engine power station only about 6.8 per cent. of the heat energy supplied can be converted into available energy at the switchboard, as compared with 13.8 per cent. obtainable in a gas engine power station.

TABLE III.—*Fuel Economy of Station—50 Per Cent. Load Factor.*

	Steam Turbine Plant.		Corliss Eng. Plant.		Producer G. Eng. Plant	
Net thermal effieiency of station at ¼ load per cent	6.8		6.4		13.8	
Cost of Coal at Furnace.	Coal Cost per Kw. Hour.	In pr ct. of Total P'w'r Cost.	Coal Cost per Kw. Hour.	In pr ct. of Total P'w'r Cost.	Coal Cost per Kw. Hour.	In pr ct. of Total P'w'r Cost.
At $2 per ton	.326c	37	.344c	38	.158c	20
At $3 per ton	.490	47	.517	48	.236	27
At $4 per ton	.652	54	.688	55	.316	34

Table IV. shows the total cost of power, which is made up of the sum of fixed charges plus the respective fuel charge.

TABLE IV.—*Cost of Power at Switchboard—50 Per cent. Load Factor.*

Cost of Coal at Furnace.	Steam Turbine Plant.		Corliss Engine Plant.		Prod'e'r G.E. Plant	
	Cost per Kw. Hour.	Cost per Kw. Year.	Cost per Kw. Hour.	Cost per Kw. Year.	Cost per Kw. Hour.	Cost p-r Kw. Year.
At $2 per ton.	0.880c	$38.00	0.911c	$39.40	.785c	$34.00
At $3 per ton.	1.044	45.30	1.084	47.00	.863	37.40
At $4 per ton.	1.206	52.20	1.255	54.30	.943	40.80

Table V. shows the amount per kilowatt-year by which the cost of the Corliss engine station exceeds that of the steam turbine and the gas engine power station respectively. Taking an average case from Table V. with coal at $3 a ton at the boiler and a 50 per cent. load factor, the saving per kilowatt-year of the steam turbine over the Corliss engine station is $1.70, reducing the cost of power 3.6 per cent., which amounts

to 1.49 per cent. interest on the capital invested. For similar conditions, the gas engine power station saves $10.60 per kilowatt-year over the Corliss engine power station, reducing the cost of power as much as 22.5 per cent., which represents 7.8 per cent. interest on the capital invested. These figures are so favorable to the gas engine that even in cases where the steam turbine plant would fail to bring any returns on the investment, the producer gas engine plant would still earn a dividend of over 6 per cent.

TABLE V.—*Saving per Kilowatt-Year as Compared to Corliss Engine Plant—50 Per Cent. Load Factor.*

	Steam Turbine Plant.			Producer Gas Engine Plant.		
Cost of Coal at Furnace.	Saving per Kw. Year.	In pr ct. of Power Cost.	In pr ct. of Turbine Plant Invest.	Saving per Kw. Year.	In pr ct. of Power Cost.	In pr ct. of G. Eng. Plant Invest.
At $2 per ton.	$1.40	3.5	1.23	$5.40	13.7	4.0
At $3 per ton.	1.70	3.6	1.49	10.60	22.5	7.8
At $4 per ton.	2.10	3.9	1.84	13.50	25.0	10.0

While this percentage may seem rather small at first sight, yet its real significance becomes apparent when taken in connection with the large sums of money involved, especially in view of the fact that the figures have been computed without prejudice and on a most conservative basis. It is manifestly safe to repudiate any new system of prime movers pretending to revolutionize power production by reducing its cost to an extraordinary degree.

The tables show clearly that fuel is the principal item in power cost, and, for average conditions, amounts to as much as 50 per cent. of the total cost in both the steam engine and the steam turbine stations. In striking contrast to this, the corresponding value in the gas power station has been reduced to 25 per cent.

The foregoing tables are deduced for producer gas engine plants. When natural, coke oven or blast furnace gas is used, the economy of the gas engine plant is considerably increased. In this case, the first cost of the producer plant, amounting to about $15 per engine horse power and the attendance and the loss of economy involved in its use, are entirely eliminated. Therefore, if the steam turbine plant, with its small increase of net efficiency over the Corliss engine plant, has so largely supplanted the latter, it is but a matter of time when the gas engine system, as justified by its many inherent advantages, must become the principal source of motive power for services of almost every kind.

A Strange Upsetting.

Early last month the force of the spring gales was well and curiously illustrated and demonstrated at the works of the Malden and Melrose Gas Light Company, Malden, Mass. In a gust during a violent gale a large steel car-crane, used for hoisting coal from a 40-foot trestle, was three-quarters overturned, and the tumble would have been completed were it not for a huge coal pile alongside the trestle at the point where the tipping happened. As it was, the end of the crane arm buried itself about 4 feet in the pile, leaving the rear wheels of the machine straightened in space. The picture tells the story, and perhaps later on Superintendent Page will narrate at greater length the happening and how equilibrium was restored.

Electrolytic Corrosion of Iron and Steel in Concrete.[1]

[Read by MR. A. A. KNUDSON, before the Am. Inst. Elec. Engineers.]

In these days of wide and rapidly growing use of reinforced concrete and hydraulic cements in all kinds of structures, the question often comes up as to whether concrete will afford to iron and steel the same protection from stray currents of electricity that it does from ordinary corrosion or rust. In the practice of investigating movements and results of currents upon underground pipes and other structures, several instances have come to our notice where damage has been caused by electrolytic action upon metals covered or incased in concrete or Portland cement.

During the last year we have frequently been asked about the probability of electrolysis upon various underground structures where the use of cement or concrete was being considered or had been used. In view of the importance of this question, therefore, we have thought it would be of service to those who are interested in the subject if more light were thrown on the true value of concrete as a supposed insulator. With a desire to obtain some definite data as to the amount of current and time necessary to cause corrosion upon metals incased in concrete or hydraulic cements, and also to test their value as electrolytes, we have made some laboratory experiments, and herewith give the results, trusting they may be of some value.

In March, 1903, blocks of concrete containing iron tubes were prepared by the writer for this purpose. These blocks or samples were made of equal parts of Portland cement and sand. They were made in ordinary metal pails slightly larger at the top than at the bottom. In the center of each block was placed a 2-inch wrought iron pipe. The dimensions of each block and the surface of iron buried are given in plan and sectional drawing, Fig. 1, and will not require further explanation; the following cuts show blocks and pipes after the tests. A few preliminary tests at this time indicated that a series of tests might bear important results, and as we lacked opportunity for making daily tests and observations, they were sent to the Electrical Testing Laboratories of this city, where excellent facilities were had for making the required measurements. Preliminary tests were made with the object of "feeling our way," and of selecting such strength of current for the series as seemed advisable. These preliminary tests not being especially important, the details are not given; but the information obtained it was decided to commence a series of tests extending over a time of 30 days with the 3 blocks immersed, and under the following conditions:

Block 2, Fig. 2, was immersed in fresh water and Block 4 in sea water. These were connected in series, with 0.1 ampere continuously flowing through them. Block 3, Fig. 3, was also immersed in sea water, but no current was sent through it. This was for the purpose of comparison after the blocks were broken open. The arrangement of the circuit is shown in Fig. 4.

These tests were commenced on February 1, 1906, and ended March 2, 1906. The results of importance upon this first group of blocks were found in the gradual disruption of the concrete, as shown by the cracks as time went on, and the appearance of electrolysis and loss in weight of the iron tubes of both No. 2 and No. 4 when the tests were concluded. Block 4 is not shown, it being quite similar to the others. During the test these cracks were noted as follows: On the 17th day a small crack down one side of block 2 was observed. On the 27th day this crack in No. 2 had a maximum width of ¼ inch and extended clear down one side, across the bottom and nearly to the top of the other side. Two cracks also appeared in No. 4. This disintegration of the concrete was a genuine surprise. The report furnished by the laboratory on this first set of experiments concludes as follows:

After the conclusion of this test, which extended over 30 days' time, the blocks were removed, and after allowing them to dry they were broken open. It was found to be quite easy to break open blocks Nos.

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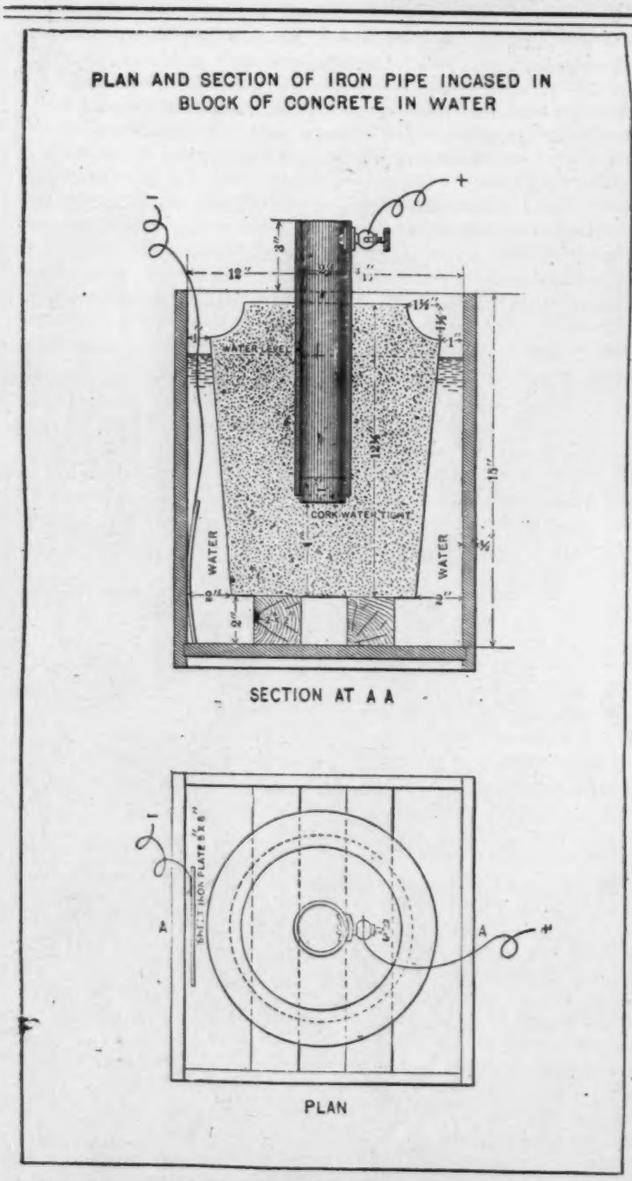

PLAN AND SECTION OF IRON PIPE INCASED IN BLOCK OF CONCRETE IN WATER
SECTION AT A A
PLAN
WATER
WATER
CORK WATER TIGHT
SHEET IRON PLATE 6" x 6"

Fig. 1.

Block 2.) Fig. 2.

2 and 4 which had already become cracked. Block No. 3, which had not been subjected to electrolysis, was broken with the greatest difficulty. Blocks No. 2 and 4 showed on their interior strong evidences of electrolytic action in the form of what was apparently a deposit of iron rust extending from the pipe toward the outside of the block. Along certain lines which acted like lines of cleavage, the cement was found to be softened so that it could readily be cut or scraped with a knife.

(Block 3, no Current.) Fig. 3.

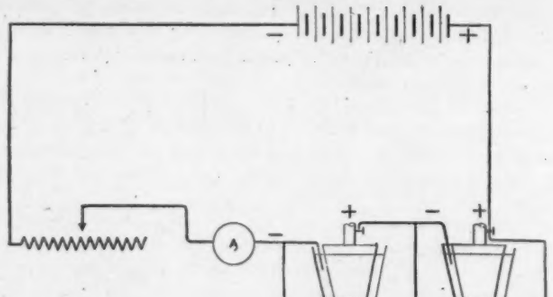


Fig. 4.

(Group 1, First Series.) Fig. 5.

This softening was such that the point of a blade of a pocket knife could be inserted into it far enough so that the knife was supported in an upright position. The pipes inclosed in Nos. 2 and 4 were found to be considerably corroded. A portion of the scale on the corroded parts

of these pipes was removed and the pipes were weighed. The pipe in block No. 3 was as bright as a new pipe. The concrete showed no evidences of a deposit of iron rust. An idea may be formed of the condition of the concrete blocks from the photographs given herewith.

Weighing of the pipes had been made by Mr. Knudson before casting them in the blocks. Weighings made at the conclusion of the experiment, together with these initial weighings, are given in the following table:

	No. 2 Fresh Water.	No. 4 Salt Water.
Initial.....	3 pound 12.50 ounce.	3 pound 7.5 ounce.
Final.....	3 " 10.95 "	3 " 6.4 "
Loss.....	1.55 ounce.	1.1 ounce.

As has been said above, the scale was not entirely cleaned off from pipes Nos. 2 and 4 before the final weighing was made, so that the loss in weight does not represent the entire amount of the electrolysis which had occurred.

The results of these experiments seemed so important that it was thought best before drawing conclusions to have the tests repeated, and, therefore, another set of experiments similar to the first was made to see how the data would compare.

Second Set of Experiments.—In this case two blocks of concrete were prepared, numbered 5 and 6 (Block 6 not shown). These were made the same as the others, except the Rosendale cement was used, called in the trade "Brooklyn Bridge Brand." The object of using a different cement was to see if there was any change in the results that could be attributed to the use of a different brand of cement. In these tests more careful and more frequent measurements were employed than in the first set of experiments. They were commenced on April 12, 1906. Two readings were made every 24 hours through the entire 30 days, and the appearance of the blocks was closely watched. The source of current, as in first test, was from a storage battery, and the pressure was increased or decreased according to the resistance, in order to maintain a constant current of 0.1 ampere.

The variation of resistance in both blocks during the test of 30 days is important. Such changes are graphically represented in Fig. 6. The

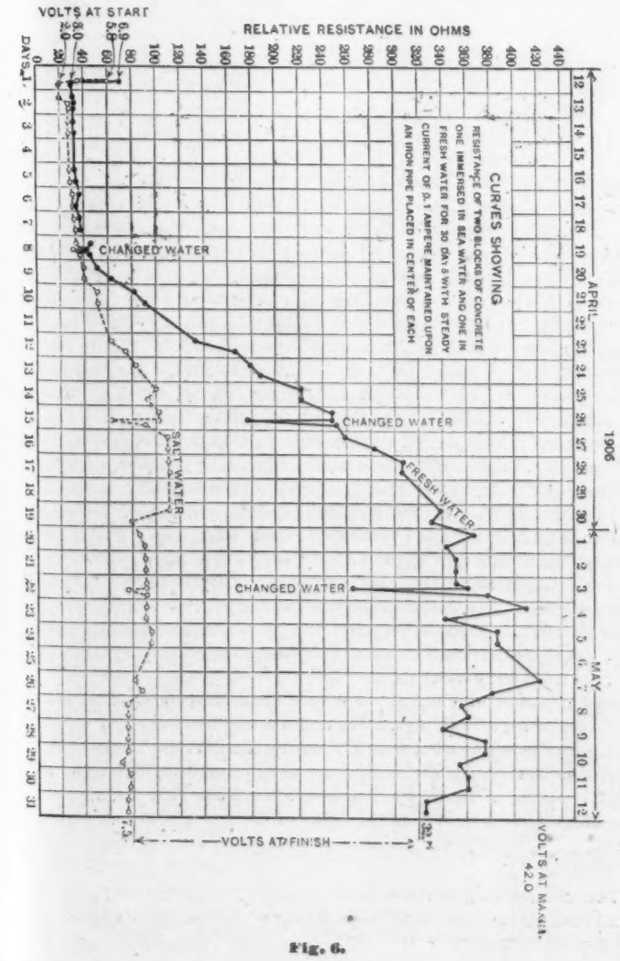

VOLTS AT START
RELATIVE RESISTANCE IN OHMS
DAYS
CHANGED WATER
SALT WATER
CHANGED WATER
FRESH WATER
CHANGED WATER
CURVES SHOWING RESISTANCE OF TWO BLOCKS OF CONCRETE ONE IMMERSED IN SEA WATER AND ONE IN FRESH WATER FOR 30 DAYS WITH STEADY CURRENT OF 0.1 AMPERE MAINTAINED UPON AN IRON PIPE PLACED IN CENTER OF EACH
APRIL
MAY
1906
VOLTS AT FINISH
VOLTS AT MAXIM. 42.0

Fig. 6.

figures showing ohms are given as relative, as they may not quite accurately represent the true values. They were obtained by simply dividing the volts by the 0.1 ampere. It was found in the preliminary trials that resistance measurements by the usual methods, such as the Wheatstone Bridge, were not accurate, owing to strong polarizing effects. For this reason the resistances as shown by these curves, while not considered absolutely accurate in every case, are sufficiently so for our purpose of examination and study.

The curve on Fig. 7 represents the sudden fall or practical breakdown

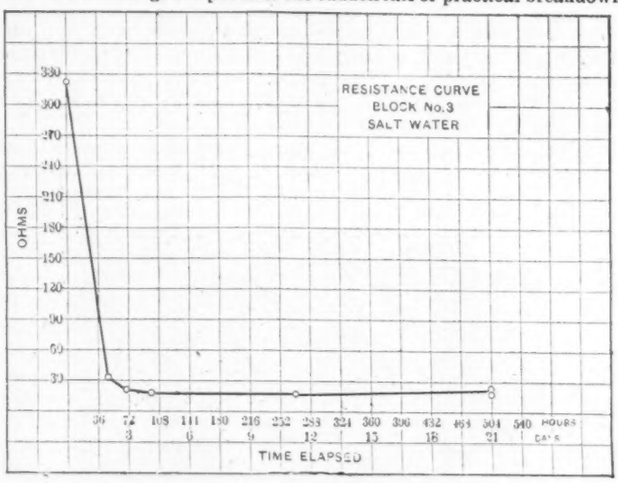


Fig. 7.

of concrete as insulation in 48 hours. The measurements in this test were made by the Wheatstone Bridge, using alternating current and a telephone receiver. They are considered fairly accurate.

Quoting from the report on this second series of tests, the following notes are of interest:

Second Day of Test.—Water appeared around the pipe of No. 5, having soaked through the concrete.

Sixth Day of Test.—Cracks were observed in both samples of concrete, those in No. 5 being the most prominent. A small amount of water was found standing in the bottom of pipe No. 5. None in pipe No. 6.

Seventh Day of Test.—The cracks in the concrete are increasing in the case of both samples.

Ninth Day of Test.—A yellow, frothy substance appeared at several points at the top of the concrete, close to the iron pipe of sample No. 6. Later this turned rust color.

Eleventh Day of Test.—Same rust colored deposit observed around pipe of sample No. 5. The cracks of both samples have increased in prominence.

Eighteenth Day of Test.—The cracks have assumed such proportions that it appears as though the concrete might easily fall apart, being $\frac{1}{4}$ to $\frac{3}{16}$ of an inch in many places. There is considerable rust colored, frothy deposit on top of sample No. 5, especially near the pipe.

It appears from these observations that before the 9th day the process of electrolysis had arrived at quite an advanced stage on both blocks and before the rise in resistance took place, which afterwards in fresh water reached 300 to 400 ohms, requiring some 30 to 40 volts to maintain the 0-1 ampere. We should not, therefore, conclude that because such high readings are not found in practice, it is a sign there can be no electrolysis. In the salt water block it is observed that even to the 11th day of the test 5.5 volts only were required to pass the 0.1 ampere, and at that time the record states the cracks in both samples have increased in prominence.

This report concludes as follows:

After the conclusion of the test, which continued over 30 days' time, the concrete blocks were removed from the water and allowed to dry. They were then broken open. Block No. 5, which had been under test in the salt water, was found to have a rust colored deposit extending along the sides of a crack from the external surface to the pipe, as shown by the accompanying photograph. The rust colored deposit in sample No. 6 was only about the pipe.

There were spots, especially in the fresh water block No. 6, where the concrete had softened to such an extent as to be readily dug out with a knife.

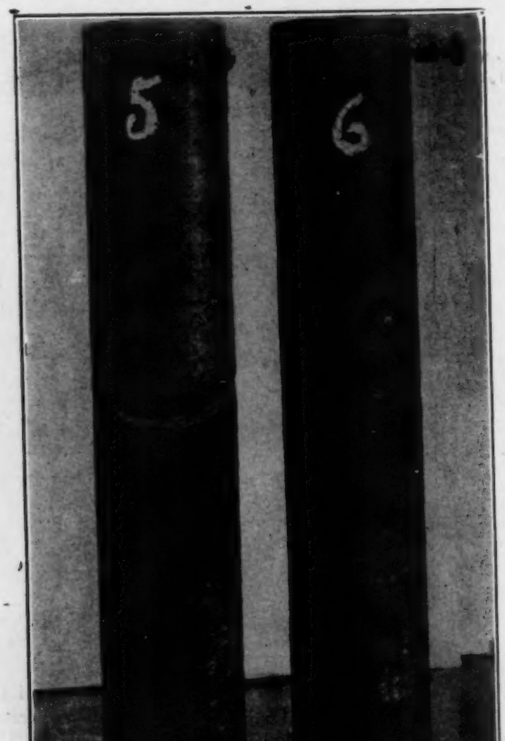
The weights of the pipe before and after the tests are given in the following table:

	No. 5 Salt Water.	No. 6 Fresh Water.
Initial	3 lb. 7.1 oz.	3 lb. 6.6 oz.
Final	3 lb. 5.5 oz.	3 lb. 5.5 oz.
Loss	1.6 oz.	1.1 oz.

Since the scale was not entirely removed for the final weighing, the loss in weight indicated does not represent the actual total amount of electrolysis which had occurred. However, all scale that could be readily removed was removed by Mr. Knudson before the final weights were taken.

This second series of tests show results very similar to the first, only more pronounced; and we believe they also show that the results would be practically the same with concrete made up with any of the different brands of cement found in the market, or made with different proportions of sand, or made of brick, or stone masonry.

The photographs of the different pipes show to some extent the effects of electrolytic action upon their surface which was in the concrete, except No. 3, Fig. 5, which had no current. No. 5, Fig. 8, which was in



(Group 2, Second Series. **Fig 8.**

the salt water block, shows the most severe case, having a hole through the iron. This hole is 1 inch long and ⅛ inch wide at its widest part, as genuine a case of electrolysis as any we have seen in larger pipes removed from a street.

Referring to the photographs of the blocks, all but No. 3 (which had no current) show the discoloration made by the iron rust, extending in most cases through what were cracks to the outside surface. No. 3 shows a perfectly clean and hard interior surface. As the report states, there was no evidence of corrosion. It was like breaking open a piece of granite, and required the services of a "hard-handed son of toil" with a sledgehammer and chisel. The other blocks which were under test could be pried apart with an ordinary screwdriver inserted in the cracks.

Attention is called to block 5, Fig. 9 (sea water), where one of the cracks is shown at the back and about the center of the curve from which the iron tube was removed. The object of using sea water in our tests, as well as fresh water, was to ascertain and compare the resistances shown in the curve sheet, and also to conform as nearly as possible to conditions found in practice, such as bridge piers and other structures located on water fronts.

These tests and experiments go to show that only a small fraction of an ampere is necessary to cause electrolytic action. The element of time being always with us, it is only necessary where electric currents

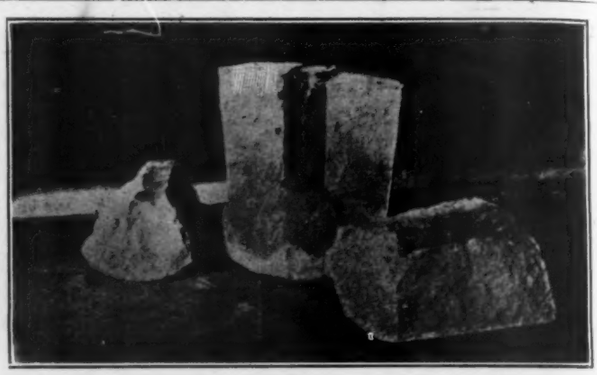


Fig. 9.

are present of sufficient voltage in the proper direction to cause even a very small amount of current to pass that will in time cause corrosion upon interior steel structures, whether placed in concrete, brick or in granite masonry. It is not expected, however, that large granite piers would develop cracks, but electrolysis to interior steel work and to bridge anchorages may go on just the same. Cracks may develop, however, in concrete piers of small bridges, such as those which cross creeks or canals.

By way of a practical illustration, there is a bridge in this city of this description over the Gowanus Canal, South Brooklyn, at Hamilton avenue. A portion of the Bridge Commissioner's report ending June 30, 1906, referring to this bridge, is as follows:

Since construction, the foundation walls of this bridge have developed some rather serious cracks, occurring on both sides of the canal, and there has been a movement of the walls towards the center of the canal. During the last 3 months this movement has amounted to ¼ an inch. Previously the movement totaled about 3¼ inches. From October to March there was practically no movement. A continuation of this movement for several inches more will result in the necessity of alterations in the center of the leaves, as they will interfere before the bridge can be fully closed.

With a view of ascertaining the electrical conditions, we have made a few tests at this bridge. The voltmeter readings show the steel structure to be positive to the canal, positive to the water mains in the street, and positive to the trolley rails on the bridge, ranging from 0.5 to 1.5 volts. These readings were taken when the car traffic was light. Some of the cracks on the concrete had been plastered over, but others were quite visible. The tests indicate that the trolley tracks on the bridge are in connection with the steel structure. Tests were also made on another bridge of the same construction a little farther north over the same canal, at 9th street. The readings here were exactly the reverse of those found at the Hamilton Avenue Bridge, the structure being negative to canal, to water mains and tracks. There were no visible cracks in the concrete of either foundation. Although the cracks in the concrete of the Hamilton Avenue Bridge are attributed to other causes in the Commissioner's report, we believe these tests and observations point strongly to electrolytic action from trolley currents as being the true cause. This seems to us the more reasonable cause for these cracks, in view of the results of our laboratory experiments just described. Ordinary care would suggest that costly structures of this kind in this or other cities should be periodically inspected for evidence of electrolytic action upon the interior steel work, especially if located contiguous to water, or in the vicinity of electric railways or railway power stations as in the case just cited. Furthermore, this question should be carefully considered when such structures are planned, and tests made at locations of proposed bridges or other structures to ascertain the electrical conditions and the possibilities of injury due to electrolysis from stray currents.

This question of electrolytic corrosion of interior steel in the construction of high buildings, however, has not been entirely neglected. There is at least one case, that of the New York *Times* Building, where provision has been made in advance as a protection. In the "Building Supplement," issued by that paper, dated January 1st, 1905, an interesting description is given in detail of the entire construction of that building. The following extract, referring to electrolysis, will be of interest:

The danger that in the case of the steel frame, rust and the disintegration of electrolysis would hasten the process of dissolution so much as to make structures of this kind prematurely unsafe through the de-

struction of their supports, was recognized in time to permit of ample safeguarding in the case of the steel frame of the *Times* building. It is axiomatic that columns to which moisture has no access will not be impaired by rusting, and that those effectually insulated from vagrant electrical currents will not be affected by electrolysis. The first consideration was to keep the basements dry. Hence the thorough waterproofing and draining of the retaining walls already described, which was carried under the floor of the press room, occupying the great area of the sub-basement. As a further safeguard, all the steel members up to the street level are incased in Portland cement mortar, to the minimum thickness of ¾ inch. This is effectual protection against rust deterioration. Under these conditions electrolytic disintegration is deemed impossible, but the probability of its occurrence in even microscopic degree is rendered still further remote by as perfect insulation as can be provided. There is sufficient grounding to relieve any electrical tension which may exist in any part of the steel frame by drawing off the current at points where electrolytic action cannot be set up.

This is the first instance we have noticed where a large corporation has recognized this danger and has taken steps beforehand to avoid it. The protection of steel structures already constructed, however, is a different matter. While plans may be made to provide insulating methods and waterproofings, before construction, it is not easy to prevent corrosive action, when the conditions are favorable, after construction.

Another point which may have an important bearing on this subject is the great pressure upon pillow blocks, and upon piers supporting as they do enormous weights, which serve to make excellent electrical contact with concrete or masonry on which they stand, and, therefore, offer further opportunity for inviting stray currents.

Figs. 10 and 11 are photographs of the under side of two water meters

Fig. 10.—300 Ft. from Nearest Track.

Fig. 11.—675 Ft. from Nearest Track.

which were practically destroyed by electrolysis while in service in the cellars of dwellings in a distant city. They were discovered during a survey by the writer in October last. They are shown as an illustration of how railway currents will follow a service pipe for a considerable distance from the tracks, enter a building and find an outlet to ground in the damp soil of a cellar. This furnishes an opportunity for current to pass into the iron foundations of large buildings where such service pipes, either water or gas, are connected, as they usually are, to the framework of such structures.

These illustrations are by no means isolated cases. We have discovered many similar cases of current straying into buildings in different cities in this country. There were three meters found destroyed in this way in different sections of the city from which they were taken. They were from 1 to 2 miles apart. The distance from the tracks of Fig. 10 was 300 feet, and of Fig. 11, 675 feet. All of these meters were on side streets, at right angles to the car tracks.

In Regard to Remedies.—Coatings of various kinds of paints or varnishes will be of little use as an insulation, for it must be borne in mind that not only a moisture resistant is required, *but an insulation that will resist continual moisture*, and also that will stand the pressure of great weights.

From these laboratory experiments, as well as observations in practice, we draw the following conclusions:

1. Steel structures are well preserved from ordinary corrosion by concrete if placed either in salt or fresh water. This, however, has long been known.

2. If but a small fraction of an ampere of electricity passes from an interior metallic column or structure into concrete or masonry as usually made, there will be corrosion of the metal and disintegration of the concrete or masonry.

3. Structures of steel in concrete that are subject to sea water are in more danger from electrolytic action than those in fresh water, by reason of the lower resistance of concrete in sea water, as shown by the laboratory experiments.

4. In no sense can concrete be considered an insulator, and, as shown, it is from all appearance just as good an electrolyte as any of the soils found in the earth.

Other investigators in this field have given valuable information on this subject. Mr. Maximilian Toch, in a paper before the American Electrochemical Society in June last, gives an interesting account of some experiments conducted by himself with steel in concrete, and although on somewhat different lines to our own, arrives at practically the same results.

Mr. M. P. Wood, in his excellent work entitled, "Rustless Coatings, Corrosion and Electrolysis of Iron and Steel," refers to this subject as follows:

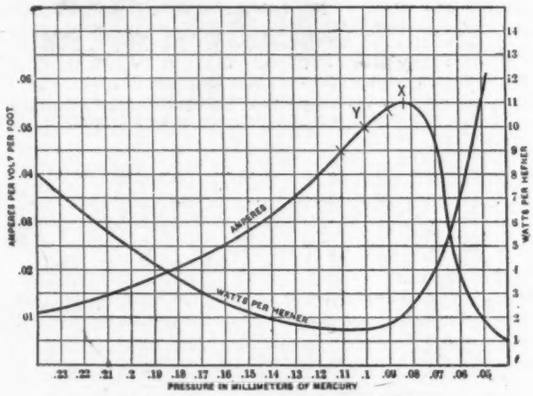
It is a false reliance that masonry, mortar, concrete or cement is impervious to moisture and incapable of acting as an electrolyte such as would induce electrolysis. They are not insulating substances, or at the best only in the smallest degree under the most favorable circumstances. They are positively porous and in nearly every case, whether tested in large or small mass, are permeable to all waters or moisture and gases, and in but a few exceptional cases ever become thoroughly dry.

It is, therefore, to be expected that so long as the single trolley with its grounded return is in general use, just so long may we look for electrolytic action in some form upon various underground structures, and reinforced concrete is no exception to this rule.

It is not at all surprising that such currents are busy at steel work of bridge anchorages. Whether inclosed in concrete or masonry, these materials, as we have endeavored to show, are no protection from straying railway currents when the conditions are favorable for electrolytic action. In view, therefore, of these items presented and the enormous uses to which concrete and hydraulic cements are now put, it would seem that this question should receive due consideration by those who have to do with planning and constructing important public works and buildings, as well as those who are intrusted with the care and safety of such structures.

April Meeting of the Am. Inst. of Elec. Engrs.

At the meeting of the American Institute of Electrical Engineers, held at the Engineering Societies Building, on April 26, Mr. D. McFarlan Moore read a paper on "Light from Gaseous Conductors within Glass Tubes," presented in assembly room No. 2 and illuminated with the Moore tube lamp. In it he described the latest form of the tube lamp with which his name is associated. The lamp consists of a continuous glass tube about 1.75 inches in diameter and of any length not exceeding 200 feet. The lamp equipment is operated from a 60-cycle alternating-current supply at any commercial voltage, the e. m. f. being increased to the value necessary for operating the tube by means of a stationary transformer. The high-potential terminals of the transformer are attached directly to the electrodes within the glass tube.



Electrical and Luminous Characteristics of Lamp.

The lamp terminals and all of the transforming apparatus and high-potential circuits are inclosed within a steel-plate terminal box.

An interesting feature of the lamp as now constructed is an automatic feeder valve which serves for maintaining the vacuum at the desired degree. Experience has shown that when no provision is made for the supply of gas to the tube, the vacuum tends to become higher in time, due to the fact that a portion of the residual gas within the tube is absorbed during the operation. The resistance of the gaseous conductor within the tube is a minimum for certain degrees of exhaustion, and it increases rapidly as the exhaustion increases or as it decreases, as shown by the accompanying curve. The critical degree of vacuum at which the conductivity is a maximum is shown at the point *X*. The tube is normally operated at a lower vacuum corre-

sponding to the point Y. It will be observed, therefore, that as the electricity uses up the gaseous conductor, the vacuum becomes higher, the conductivity better and a greater current flows through the circuit. Use is made of this characteristic of the vacuum tube to maintain the vacuum at the desired degree. A feeder valve is arranged to permit air or other gas to enter the tube just when it is needed and in an entirely automatic manner. This valve is in reality a mercury seal operated by means of an electromagnet whose coil is connected in series in the supply circuits. The mercury serves to seal the pores of a carbon plug. The action of the solenoid is to lift a concentric glass tube partly out of the mercury, the surface of which falls and thereby causes a minute tip of the conical-shaped carbon plug to be slightly exposed for a second or two and an extremely small quantity of air or other gas filters through the porous section of the plug and finds its way into the vacuum tube proper. In normal operation the carbon tip is exposed for about one second every minute. When the air is admitted the resistance of the tube increases and the current through it decreases, and therefore the feeder magnet becomes weakened and the air or gas inlet is closed.

The luminous efficiency of the tube lamp depends not only upon the value of the current at which it is operated, but varies with the nature of the gas used in the tube. Carbon dioxide gas gives a perfectly white light, while the light from nitrogen gas has a pink tint. When it is desired to feed the tube on nitrogen, air is made to pass through a small iron cylinder containing a supply of phosphorus. In order to prevent more air than necessary from coming into contact with the phosphorus, the air is first required to pass through a small mercury trap. When the tube is to be fed with carbon dioxide gas the gas is generated automatically by means of the action of hydrochloric acid on marble.

Discussion.

Dr. C. P. Steinmetz stated that Mr. Moore's paper furnished the first actual engineering data relating to the tube lamp; that is, the actual power, current and illumination. By changing over the units employed in measuring the illumination from the tube lamp to the units ordinarily used with incandescent and arc lamps, he showed that the Moore lamp consumes about 2.5 watts per mean spherical candle power. Thus its specific consumption is less than that of the carbon incandescent lamp, about equal to that of the tantalum lamp, but is inferior to that of the tungsten lamp. These values refer to the lamp with which the nitrogen gas is used; the specific consumption of the tube using carbon dioxide is somewhat greater. The Moore tube lamp has, therefore, arrived at that stage where it is in the range of commercially practical efficiency as an illuminant. The lamp has been enormously improved within the last few years. One of the most important and valuable features of the present lamp is the valve by which the nitrogen or carbon dioxide is automatically led to the tube. The production of a valve which is capable of maintaining a vacuum of about .000125 of atmospheric pressure is indeed a remarkable achievement.

Mr. Percy H. Thomes remarked that in addition to supplying a new candidate for commercial favor among the illuminants, Mr. Moore has done a good deal to educate illuminating engineers to consider the importance of diffusion and distribution in lighting. The diffusion from the Moore tube is perfect in one plane, but very imperfect in a plane at right angles thereto. It is even possible with incandescent lamps distributed over the ceiling to get a more perfect diffusion than with the tube. Undoubtedly there is a field for the tube lamp. Its good points are its relatively high efficiency, its diffusion and the fact that it produces no bright, brilliant spots. Its chief difficulties will be found in a tendency to fail at times. When the whole illumination in a room is dependent on one or two lamps, it is impossible to use a small portion at one time. This fact merely indicates a certain limitation when the broad field of illumination is considered, but it cannot be urged against the tube for all places.

Dr. C. H. Sharp stated that the tube containing nitrogen is about twice as efficient as the one using carbon dioxide, the watts per candle for the latter ranging from 3 to 5.8. The gain in efficiency of the nitrogen tube over the carbon filament lamp is by no means revolutionary. Its efficiency is considerably less than that of the tungsten lamp. The indivisibility of the light from the Moore lamp will probably make it necessary in all or nearly all of the installations where it is used to supplement it by some other lighting system, because it would not be proper to place all the reliance for the lighting of a room upon a single glass tube.

Mr. J. W. Howell stated that Mr. Moore had for 12 years stuck to his work of producing a commercial tube lamp with a persistence and enthusiasm which he had never seen equalled. He has added a commercial illuminant which is applicable for many places, such as the art gallery, because when it is installed all elements of danger are eliminated.

Mr. Leon Gaster, of London, England, remarked that, while the Moore tube had been developed before high-efficiency incandescent lamps had been introduced, it is unfortunate that it must now compete with the more recently introduced tungsten and similar high-efficiency lamps, which consume only one watt per candle. Thus the excellent work of the inventor will not receive the financial reward which it deserves.

Chairman Gano S. Dunn called attention to the fact that from illuminating tests made upon the three lighting equipments installed in the lecture room, it was found that 10 kilowatts were required for the lamps behind the cove; 5 kilowatts with naked lamps strung around the border, and 5 kilowatts to illuminate with the Moore tube. It was evident to all that the tube gave a brighter light than either of the other systems. The test was a practical one, concerning which there could be no discussion as to photometry, brilliancy or efficiency.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. EDMOND E. MILLER has resigned as Manager of the new business department of the Cincinnati Gas and Electric Company, and of its successor, the Union Gas and Electric Company. Mr. Miller and his family will make a prolonged touring trip through Europe, after which he will return to the business life.

THE Bay City (Mich.) Gas Company has filed a certificate announcing an increase in its capital stock of $31,000. The total now outstanding is $375,000.

GAS was turned on to Boyertown, Pa., through the mains of the new Boyertown Gas Company, last week.

MR. W. R. GOUDY, formerly with the Sioux City (Ia.) Gas and Electric Company, will hereafter act as Secretary to the Syracuse (N. Y.) Lighting Company, vice Mr. Louis L. Waters, resigned. The latter was a very capable official.

AT the annual meeting of the Charleston (S. C.) Consolidated Railway, Gas and Electric Company, the officers elected were: Directors, E. H. Pringle, P. H. Gadsden, J. S. Buist, G. W. Williams, G. B. Edwards, Wm. M. Bird, J. B. C. Bradley, J. M. Cameron and S. H. Wilson; President, P. H. Gadsden; Managing Director, S. H. Wilson; Secretary, P. J. Balaguer.

A VERY interesting lecture on the "Municipal Gas Works of Berlin," was spoken by Prof. Robert C. Brooks, of Swarthmore College, in the rooms of the City Club the afternoon of the 27th ult. The matter was put forth in the Professor's best style, and he surely had the close attention of a very intelligent audience. When the lecture proper was at an end the Club resolved itself into a "Quiz Class," the subject being the advantage or disadvantage of municipal control of gas enterprises. In the course of the debate the Professor put himself clearly on record as opposed to the ownership by the municipality of public utilities in general.

THE last quarterly report submitted to the authorities of Providence, R. I., by the Providence Gas Company respecting the business done by the Company in the quarter ended March 31st last, shows that the gross earnings were $285,156.50. The 3 per cent. thereon which goes to the city as a royalty amounted to $8,554.69. For the corresponding period of 1906 the earnings were $260,395.15.

MANAGER PETTIBONE, of the municipal gas plant in Westfield, Mass., is in the market for a gasholder. The amount appropriated for its construction is $25,000.

ALL the preliminaries respecting the consolidation of the gas and electric lighting interests in La Crosse, Wis., have been arranged. The successor to the joint properties is the La Crosse Gas and Electric Company, and Mr. C. H. Williams will have active control as Business Manager.

MR. S. M. HIGHLANDS has retired from the gas business—more's the pity—having disposed of the valuable interests held by him therein. However, he still seems to have an eye to the main chance, as the following transcription from his letter head, bearing date Muncie, Ind., shows: "S. M. Highlands. Money to Loan. Farm Mortgages Wanted." Well; he was a rattling, good gas man. So who may doubt his benignity as a "Lord of the Manor." None.

SOME weeks ago there was introduced in the Connecticut General Assembly a bill that proposed to confer upon the New London Gas and Electric Company the right of eminent domain. After some consideration, however, the matter appealed so strongly to the general lighting interests of the State that, after a conference, it was decided to offer a general bill. This provides that companies engaged in transmitting electricity for supplying light, heat or power, under the authority of special charters, shall have the right to take such real estate as may be necessary for the purpose of establishing its transmission lines if it cannot be obtained by agreement. A finding of public necessity and convenience must be made by a judge of the Superior Court after a hearing. The court, if it makes the finding, shall appoint 3 appraisers to estimate damages, who shall make their finding of damages in writing to the clerk of the Superior Court for record and, when so recorded, the appraisal shall have the effect of a judgment. The company interested

must pay the persons concerned the amount of the appraisal within 60 days of the time it is recorded.

RATHER stringent it seems to us are the conditions which this city seeks to impose upon the New York and Richmond Gas Company, as a result of its petition for an extension of its franchise. Although the Company seeks only the right to go through certain parts of Richmond county, and binds itself in many ways to render effectual service to the residents thereof, the Borough is asking a tax in the shape of an "annual rental" that would cause us to think at first thought that Richmond county was pretty well in the heart of the tenderloin district.

TROPICO, CAL., is just now agitating the subject of granting a franchise for the operation there of a gas works.

AT the annual meeting of the shareholders in the Columbus (O.) Gas and Fuel Company the Directors elected were: H. D. Turney, F. C. Hubbard, E. K. Stewart, Geo. W. Sinks, C. D. Firestone, D. E. Putnam and D. Wilson—the last named succeeds the late Mr. J. O. Johnston.

FROM the royalty returns, under the agreement between Philadelphia and the U. G. I. Company, for the quarter ended March 31st last, the payment made to the authorities was $213,649.70. Which shows that the output for the first quarter was 2,106,863,900 cubic feet. The output for the preceding quarter was 1,928,542,230 cubic feet.

THE authorities of Buffalo, N. Y., have accepted the check tendered by the Buffalo Gas Company in the sum of $244,098.42 as full payment of all demand on its franchise account to date of May 1st.

THE properties of the Huntsville (Ala.) Gas Company have been purchased by the Indiana syndicate which controls the operations of the New York-Alabama Oil Company, which concern is largely interested in the natural gas wells of West Huntsville.

A VERY interesting case was recently determined by Vice-Chancellor Leaming in the suit of Chas. F. Thatcher against the Consumers Gas and Fuel Company, of Atlantic City, N. J. The bill in the case was filed by plaintiff, a stockholder in the Company, who based his proceeding on the ground that the act of March 27th, 1878, restricts the bonded indebtedness of gas companies to ⅓ the amount of their capital stock, The Chancellor declares: "The only question here involved is whether or not the act of March 27, 1878, operates to render it unlawful for a gas company which is incorporated under what is known as the general gas company act (April 21, 1876), to issue bonds to the amount in excess of ⅓ of the amount of its capital stock." He then touches on the history of special acts passed prior to that of 1878, containing provisions authorizing money to be borrowed and bonds to be issued to an extent varying from ⅓ of the capital stock to sums without restriction at all. He avers the purpose of the act of 1878 was "to enable gas light companies, incorporated under the laws of the State, to increase their bonded indebtedness. The provisions of the act enabling the increase of bonded indebtedness necessarily assumes in the corporations affected by it a pre-existing but restricted power to create a bonded indebtedness. This clearly negatives any possible legislative purposes to apply the operation of the act to corporations already possessing the powers without restriction, and, therefore, excludes from any rational legislative interest such corporations as already possessed the power to create bonded indebtedness to a greater amount than that named in the act. I think it clear, therefore, that the act can only be regarded as an act conferring additional powers on such corporations as were previously restricted in the particulars referred to."

MR. C. E. STREET, President of the Peoples Gas and Electric Company, of Oswego, N. Y., declares that, under the scheme of reconstruction and enlargement proposed for the named plants, at least $150,000 will be requisite.

MR. WM. H. ADAMS, of Portland, Ore., has arranged for the taking over, for exploitation, of his producer gas systems, by a local Company organized under the laws of Oregon.

THE stock of the Mechanicsburg (Pa.) Gas Company has been increased in the sum of $25,000.

THE Massachusetts Board of Gas and Electric Light Commissioners has granted the petition of the Watertown Light and Power Company to increase the mortgage upon its property from $800,000 to $1,000,000, this being done by amending the order of January 18th, 1907, under which the Watertown Light and Power Company was authorized to acquire the Watertown Electric Light Company property for $425,000 and the H. Remington & Son Pulp and Paper Company property for $275,000. This consent to raise the amount of the mortgage does not increase the present capitalization, as no more bonds can be issued under the order as amended than could have been put out before, but it makes a provision whereby the million dollars' worth of bonds can be issued in case subsequent investments and improvements render it proper and necessary, in the opinion of the Commission. An order has also been granted by the Commission providing that the maximum price for gas, which shall be charged to consumers by the Watertown Gas Light Company, shall be $1.25 per 1,000 cubic feet; for bills rendered by the 6th of the month and not paid on or before the 15th of the month, an increased charge of 10 cents per 1,000 cubic feet will be made. Also an order has been granted by the Commission, providing that the maximum price for electric current, except to the city for public arc lighting, is fixed at 10 cents per kilowatt hour; and for bills rendered by the 6th of the month and not paid on or before the 15th of the month, an increased charge of 2 cents per kilowatt hour will be made.

THE proprietors of the Manitowoc (Wis.) Gas Light Company have offered to sell that plant to the city for the sum of $160,000.

THE projectors of the gas plant for Bellows Falls and North Walpole, Vt., are endeavoring to secure a franchise from the town of Walpole, which is on the banks of the Connecticut river, directly across from North Walpole.

THE betterments involved in the reconstruction of the Greenfield (Mass.) Company will involve an expenditure of $75,000.

MR. FRANK W. FRUEAUFF will shortly leave Denver, Col., to make his headquarters in New York city as first lieutenant for Mr. Henry L. Doherty.

THERE is every indication that the Union Gas and Electric Company, of Cincinnati, O., has made an arrangement with the controllers of the Ohio Fuel Supply Company and the Natural Gas Company, of West Virginia to take over the supplying of natural gas to the residents of the Queen City.

THE ownership of the Durham (N. C.) Light and Power Company has passed to New York capitalists, who were largely interested in the Company's bonded indebtedness.

THE United Gas Improvement Company, which is now in absolute control of the business of the Syracuse (N. Y.) Lighting Company, has appointed Mr. J. C. De Long to manage the electrical division of the Syracuse enterprise. We are very much pleased to here say that Mr. John J. Cummins will continue as the executive head of the Syracuse Company.

THE business done by the Peoples Gas Light and Coke Company, of Chicago, in the quarter ended March 31, 1907, was the greatest recorded in its history, the excess over the corresponding quarter of 1906 being not quite 12 per cent.

MR. ARTHUR M. SMITH writes us, as Secretary of the Gas Machinery Company, of Cleveland, O., that it will hereafter be represented on the Pacific Coast by the Hallidie Machinery Company, Seattle, Wash. Mr. E. Howard Corbett, formerly of New York, has charge of the gas division of the Hallidie Company's trading.

ACCORDING to the valuation put thereon by the appraisers, the main system of the Consumers Gas Trust Company "in and around Indianapolis, Ind.," is worth $409,060.42—especially the 42 cents.

HEREAFTER the lighting and extinguishing of the gas and naphtha lamps maintained on public lighting account in Boston, Mass., will be done on public account, instead of by the lighting contractors.

GAS was turned on by the Calumet (Mich.) Gas Company for the first time the 1st inst.

GAS arcs for public lighting are finding great favor in Kansas City, Mo. However, a like remark applies to any place in the States.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
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MONDAY, MAY 13, 1907.

The Market for Gas Securities.

Indecision, dullness and weakness characterized the market for city gas shares last week. The opening to-day was made at 131½ to 132, but the prices were altogether nominal. The anxious ones are predicting an early presenting of the decision of the Master in the Circuit Court proceedings. Brooklyn Union is dull and lower, the bid price having gone back to 118.

Massachusetts common is 62 to 62½, and 85½ is bid for the preferred. Peoples, of Chicago, is 92½ bid, which is certainly low for a safe 6 per cent. security. New Jersey gas securities are booming, and it is likely that a further sharp rise will shortly take place in the Public Service Corporation issues.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

MAY 13.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	131¼	132
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	101	104
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	..	105
Mutual	3,500,000	100	190	225
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000 000	1,000	98	100
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p.ct.	1,000,000	..	98	104
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	101	103
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	108	111
Con. 5's, due 1945, J. & J.	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
1st Mtg. 5's, due 1930, M. & N	1,500,000	1,000	104	108
The Brooklyn Union	15,000,000	1,000	118	120
1st Con. 5's, due 1948, M. & N	15,000,000		167	..
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Bay State	50,000,000	50	¼	⅜
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	500,000	1,000	95	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000.000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	98	99
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,582,750	100	87	88
Preferred	3,096,500	100	107½	108
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	.	90
Mortgage, 6's	3,000,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	980,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
Bonds, 5's	10,500,000	..	107½	108½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,333,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	05
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	104	104¼
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,006	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Massachusetts Gas Companies of Boston	25,000,000	100	62	62¼
Preferred	25,000,000	100	85¾	86
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	6,000,000	..	137	138
New Haven	2.000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	92¼	92½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
" 2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	104½	105¼
San Francisco, Cal.	15,800,000	100	..	..
St. Joseph Gas Co. 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,000,000	20	300	305
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600.000	50	220	..

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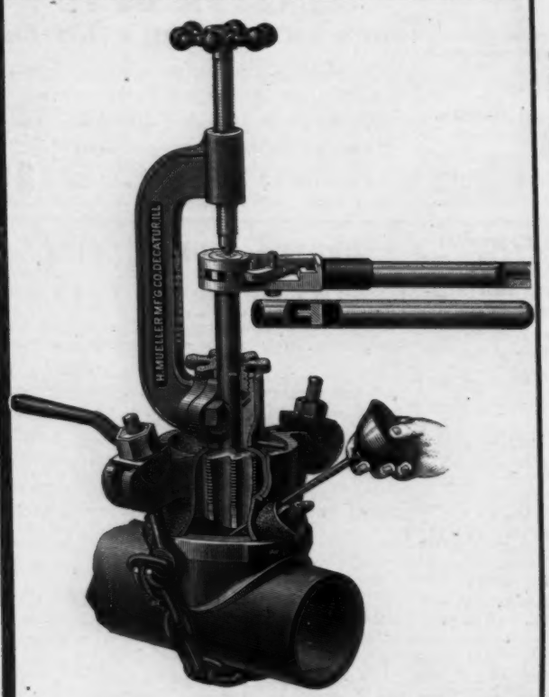

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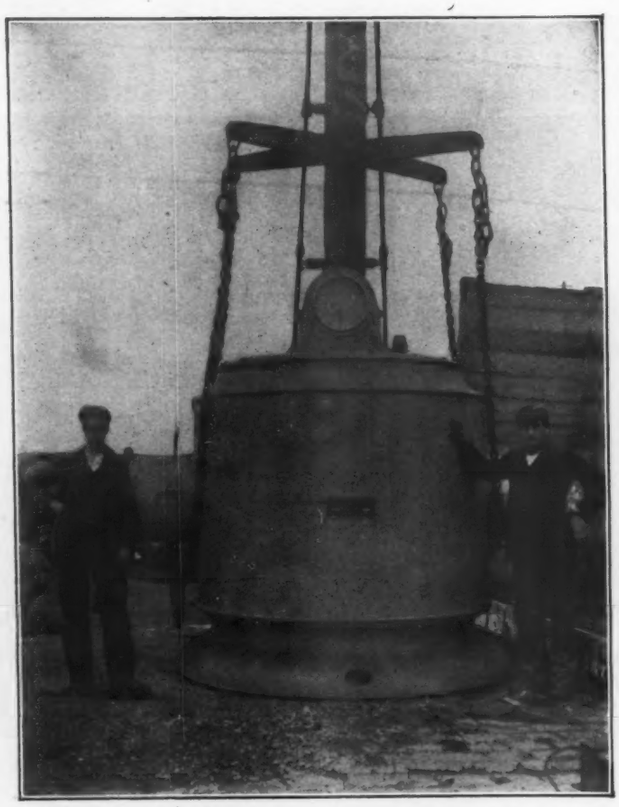

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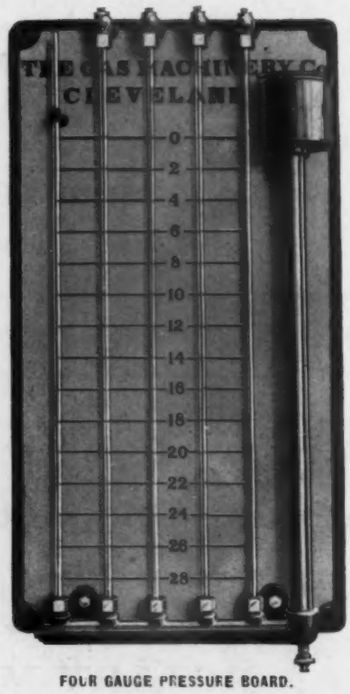

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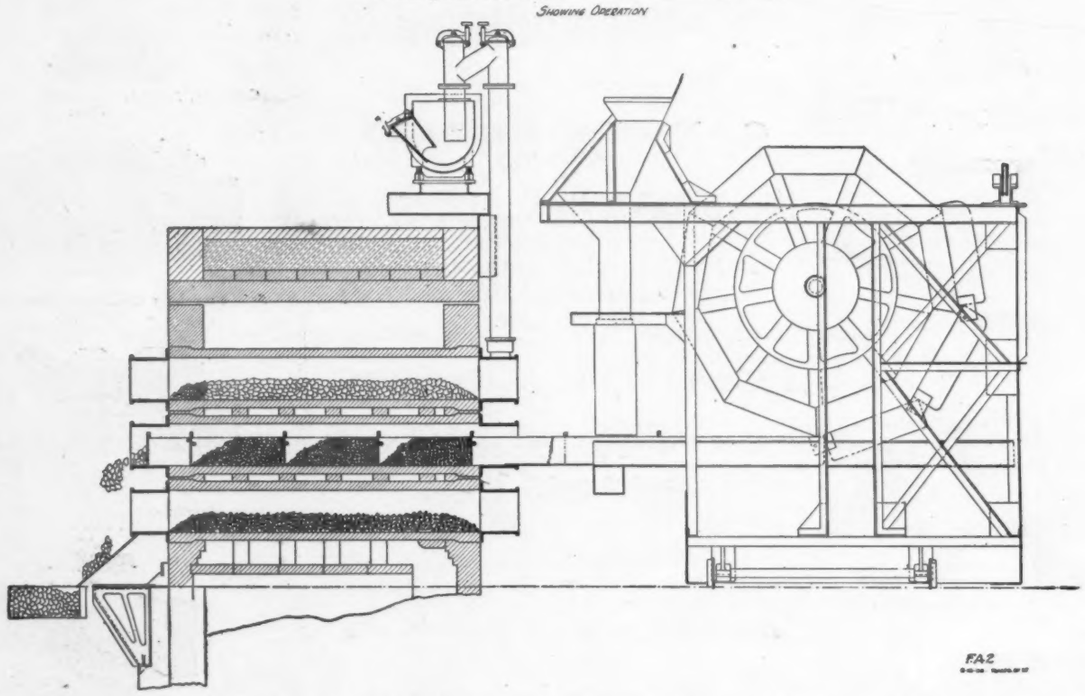

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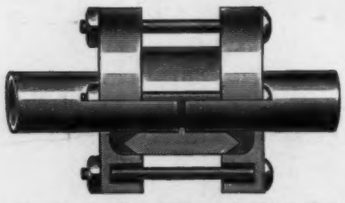
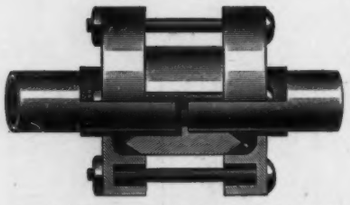


Regular Coupling, Style 1, for Plain End Wrought Iron Pipe.



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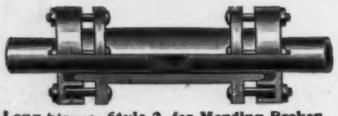

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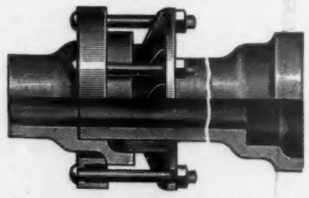
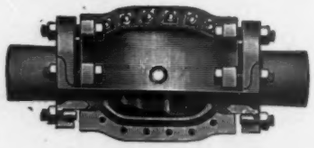
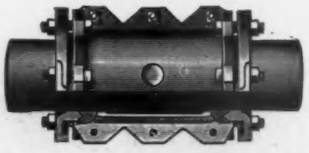


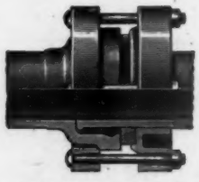
Coupling, Style 9, for Special Style Cast Iron Pipe.



Split Sleeve for Repairing Broken Bell on Cast Iron Pipe.



Split Sleeve for Repairing Broken or Cracked Cast Iron Pipe.



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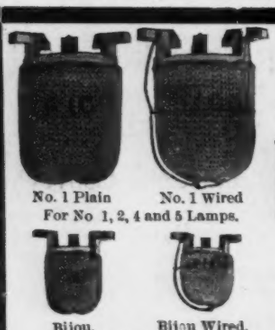

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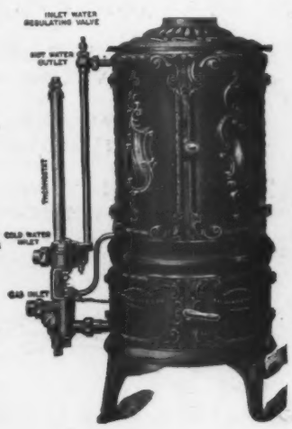

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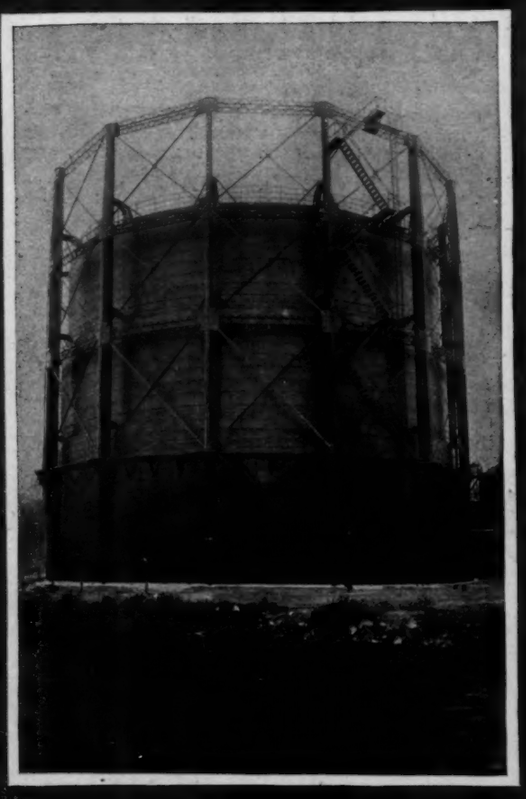

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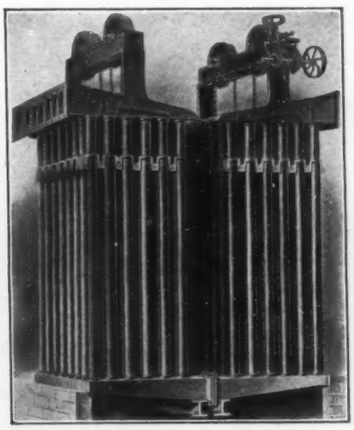

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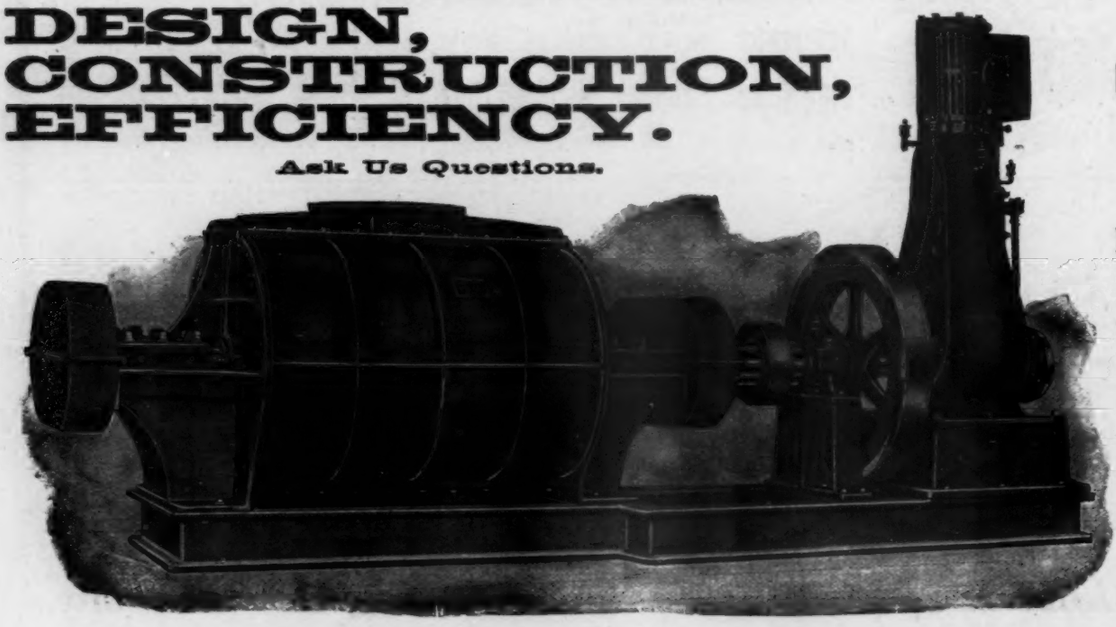

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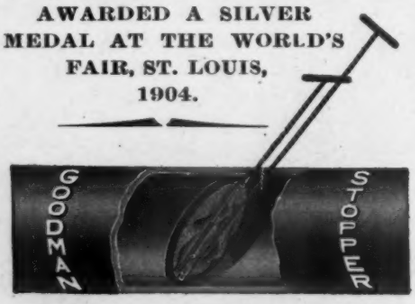

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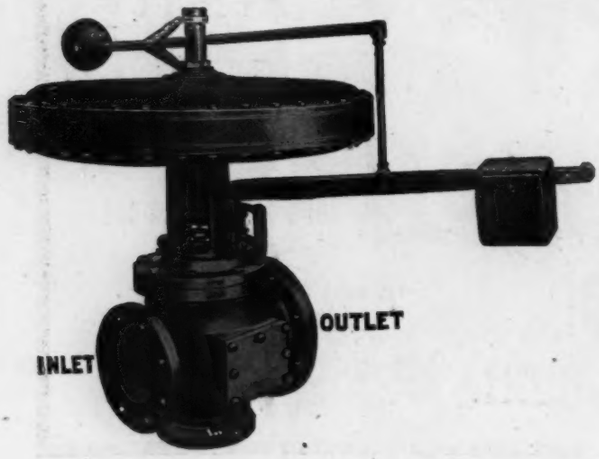

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AMERICAN METER CO.,

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Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

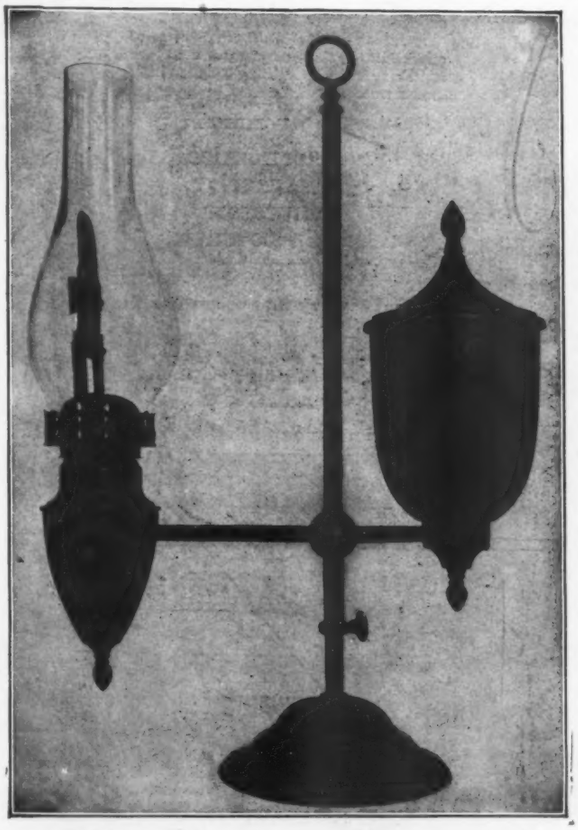
MAY, 1907.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Wed.	1	7.20 PM	12.00 PM
Thu.	2	7.20	1.00 AM
Fri.	3	7.20	1.50
Sat.	4	7.20 LQ	2.40
Sun.	5	7.30	3.20
Mon.	6	7.30	3.50
Tue.	7	7.30	3.50
Wed.	8	7.30	3.50
Thu.	9	7.30	3.50
Fri	10	7.30	3.50
Sat.	11	7.30 NM	3.50
Sun	12	7.40	3.50
Mon.	13	7.40	3.50
Tue.	14	7.40	3.50
Wed.	15	7.40	3.50
Thu.	16	10.00	3.50
Fri.	17	10.40	3.50
Sat.	18	11.20	3.50
Sun.	19	12.00	3.40
Mon.	20	12.30 AM FQ	3.40
Tue.	21	1.00	3.40
Wed.	22	1.30	3.40
Thu.	23	2.00	3.40
Fri.	24	2.30	3.40
Sat.	25	3.10	3.40
Sun.	26	No L.	No L.
Mon.	27	No L FM	No L.
Tue.	28	No L.	No L.
Wed.	29	7.50 PM	10.50 PM
Thu.	30	7.50	11.50
Fri.	31	7.50	12.40 AM

TOTAL HOURS DURING 1907.

By Table No. 1.

	Hrs.Min.
January	211.10
February	193.40
March	182.10
April	167.00
May	157.00
June	145.30
July	151.50
August	162.30
September	175.30
October	202.40
November	209.30
December	231.50
Total, yr.	2190.20



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***

10-Candle Power.

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This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

MAY, 1907.

Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Light	Extinguish.
		P. M.	A.M.
Wed.	1	6.45	4.00
Thu.	2	6.45	4.00
Fri.	3	6.45	4.00
Sat.	4	6.45	4.00
Sun.	5	6.45	4.00
Mon.	6	6.45	4.00
Tue.	7	6.55	3.40
Wed.	8	6.55	3.40
Thu.	9	6.55	3.40
Fri.	10	6.55	3.40
Sat.	11	6.55	3.40
Sun.	12	6.55	3.40
Mon.	13	6.55	3.40
Tue.	14	7.00	3.30
Wed.	15	7.00	3.30
Thu.	16	7.00	3.30
Fri.	17	7.00	3.30
Sat.	18	7.00	3.30
Sun.	19	7.00	3.30
Mon.	20	7.00	3.30
Tue.	21	7.10	3.15
Wed.	22	7.10	3.15
Thu.	23	7.10	3.15
Fri.	24	7.10	3.15
Sat.	25	7.10	3.15
Sun.	26	7.10	3.15
Mon.	27	7.10	3.15
Tue.	28	7.15	3.15
Wed.	29	7.15	3.15
Thu.	30	7.15	3.15
Fri.	31	7.15	3.15

TOTAL HOURS DURING 1907.

By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 512 Oak Street.

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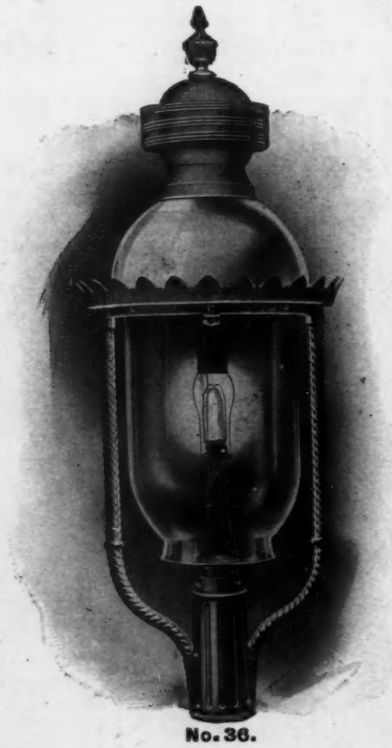
....OF AMERICA....



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Council Bluffs, Ia. (2d contract).
Seattle, Wash. (2d contract).
Philadelphia, Pa.
Waterbury, Conn.
Manchester, N. H.
Allentown, Pa.
Omaha, Neb.
Muskegon, Mich.
Nazareth, Pa. (2d contract).
Lewistown, Pa.
Greenville, Tex.
New York, Cent. Un. (3d contract).
Jefferson City, Mo.
Peekskill, N. Y. (2d contract).
Waterville, Me.
Washington, D. C. (4th contract).
Lawrence, Mass. (3d contract).
Hampton, Va.
Aurora, Ills. (2d contract).
Milwaukee, Wis.
Syracuse, N. Y. (2d contract).
Davenport, Ia.
S. Brooklyn, N. Y. (3d contract).
Delray, Mich.
Albert Lea, Minn. (2d contract).
Leominster, Mass. (2d contract).
Clinton, Mass.

TOTAL SETS INSTALLED IN 1906, ... 41
TOTAL SETS TO DATE, ... 634
TOTAL DAILY CAPACITY, ... 502,555,000 cu. ft.

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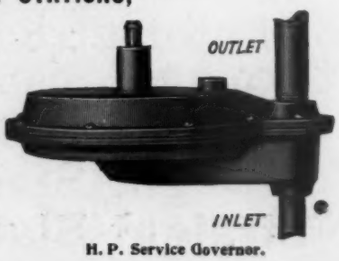

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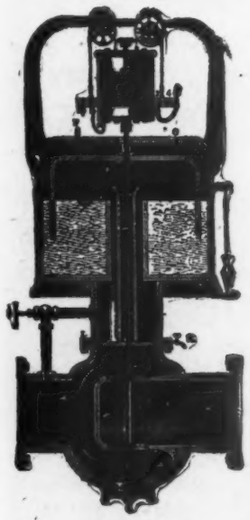

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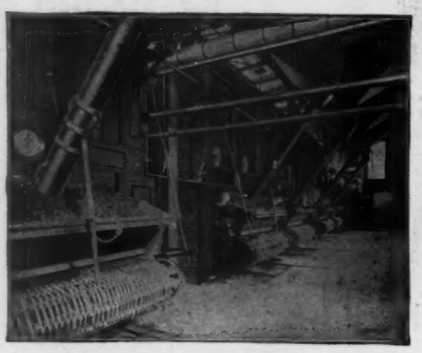

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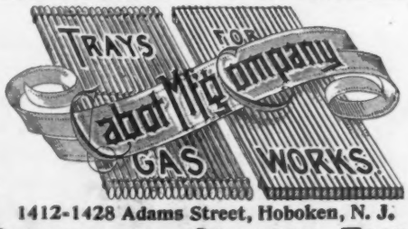

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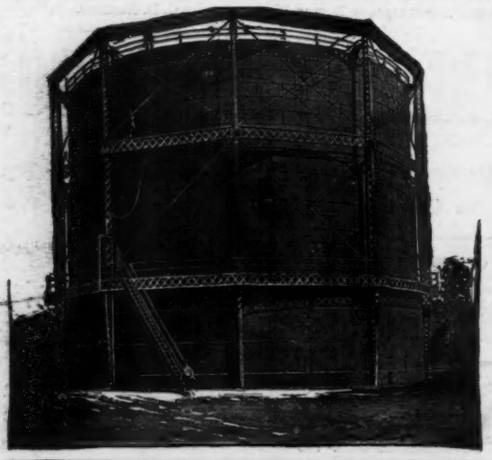

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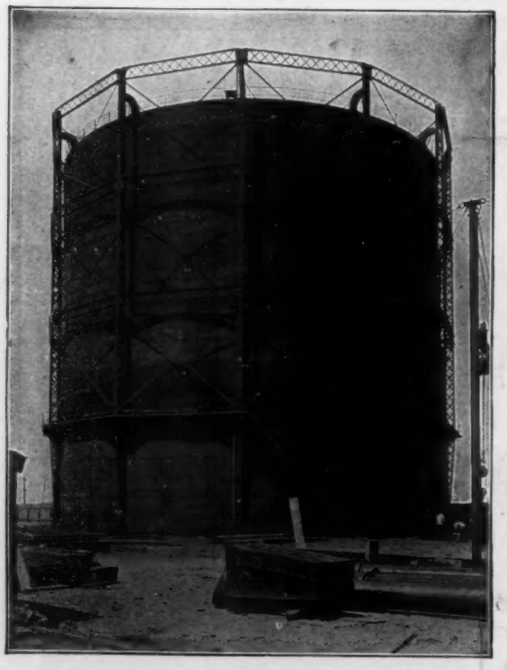

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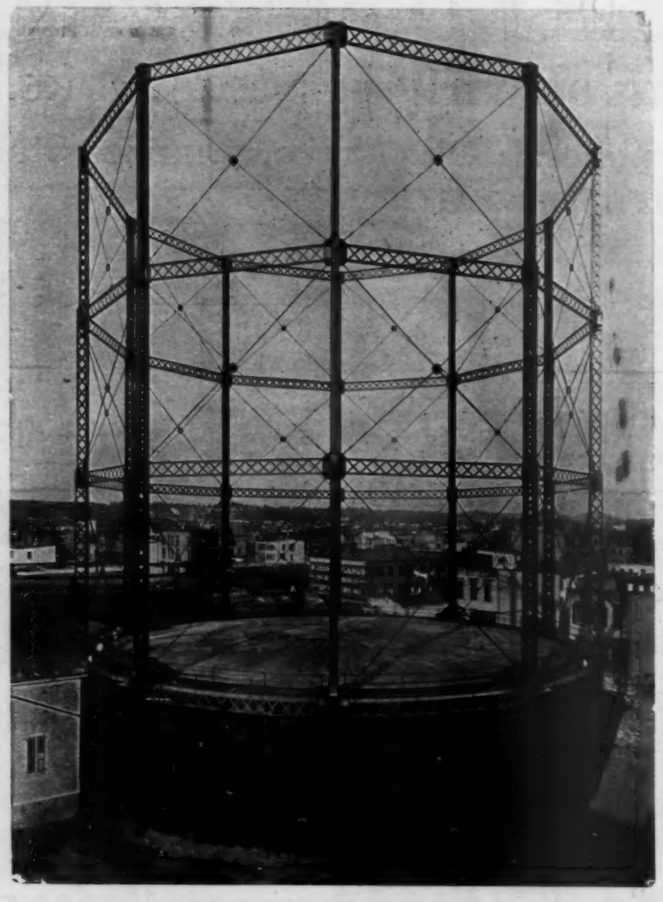

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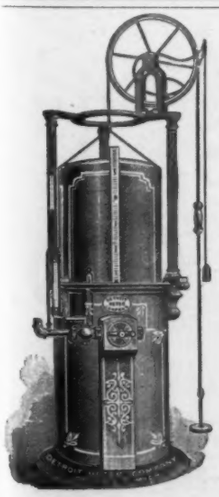

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